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NUEXCO

Monthly Report

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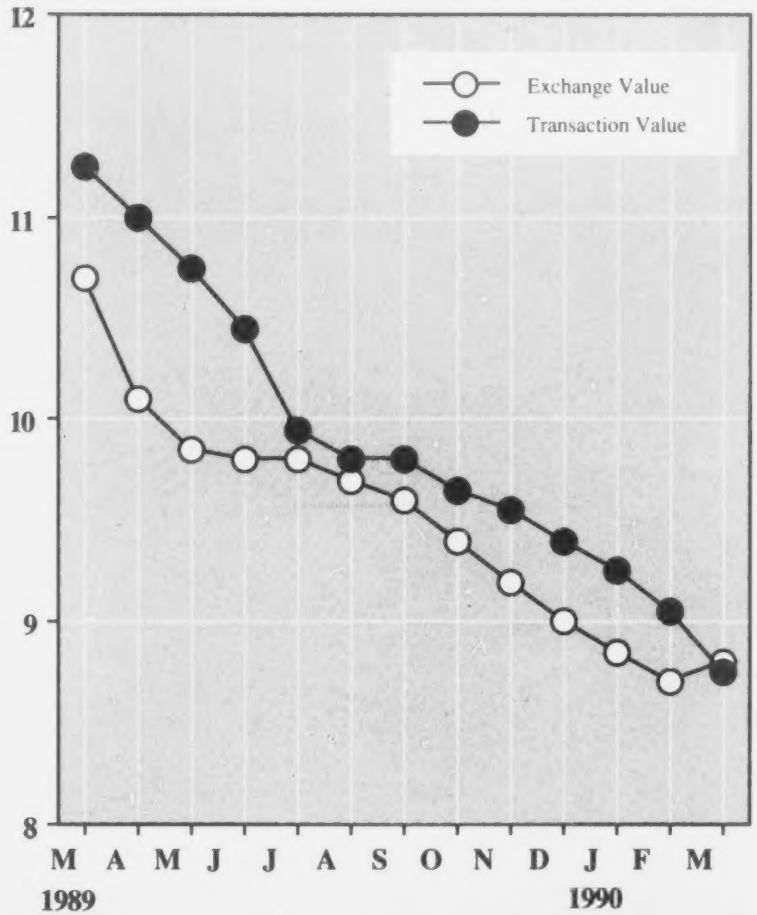

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NUEXCO MONTHLY REPORT
April 1990, No. 260
* * *
EXECUTIVE SUMMARY
(As of March 31, 1990)

Exchange Value
$8.80, up $0.10

The **Exchange Value** is **$8.80** per pound U_3O_8, up $0.10 from February 28.

UF_6 Value
$24.40, down $0.85

The **UF_6 Value** is **$24.40** per kg U as UF_6, an $0.85 decrease from the February 28 UF_6 Value.

Uranium Sales; Supply and Demand

Eight March **uranium** sales involved **5.2 million** pounds equivalent U_3O_8. Three of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **3.8 million** pounds equivalent U_3O_8, down from 5.1 million pounds at the end of February. Active spot and near-term **uranium demand** totals **4.5 million** pounds, up from 3.7 million pounds on February 28. The spot and near-term **supply-demand ratio** is **0.9 to 1**, down from the February 28 figure of 1.4 to 1.

Transaction Value
$8.75, down $0.30

The **Transaction Value** is **$8.75** per pound U_3O_8, down $0.30 from February 28. The calculation includes 13 transactions over a period of three months involving a total of 4.4 million pounds equivalent U_3O_8.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged for the past 29 months. Five natural uranium loans are reported involving over 1.6 million pounds equivalent U_3O_8.

Conversion Value
$1.45, down $0.05

The **Conversion Value** is **$1.45** per pound U as UF_6, down $0.05 from February 28. Two transactions for conversion services are reported.

SWU Value
$50, unchanged

The **SWU Value** remained at **$50** per SWU. Six SWU sales are reported. Active supply is down from 415 to 345 thousand SWU, and active demand dropped from 265 to 95 thousand SWU.

* * *

The Long And The Short Of It

George White, Jr., in his speech before the USCEA Fuel Cycle '90 Conference on March 26, reminded the audience that the current state of affairs in the uranium market is the inevitable economic result of past excesses, primarily the buildup of huge inventories during the late 1970s and early 1980s.

Liability in Shipping Radioactive Materials

For more than forty years, and to the credit of the nuclear industry, accidents in shipping radioactive materials have been rare. Nevertheless, any party remotely connected with a shipment that results in a serious accident is potentially liable. Robert L. Bovey, in his speech before the USCEA Fuel Cycle '90 Conference on March 26, discussed some of the questions that should be asked about radioactive material transportation liability insurance.

South Korea's Nuclear Fuel Industry

South Korea's fuel fabrication plant began commercial operation in March, marking the culmination of the country's efforts, initiated in the mid-1970s, to develop self-sufficiency in nuclear fuel fabrication.

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NUEXCO MONTHLY REPORT 260 FIGURES OF THE MONTH (March 31, 1990)	This Month (Report 260)	Last Month (Report 259)	12 Months Ago (Report 248)
Exchange Value ($US per pound equivalent U_3O_8)	8.80	8.70	10.70
UF_6 Value ($US per kg U as UF_6)	24.40	25.25	33.00
Transaction Value ($US per pound equivalent U_3O_8)	8.75	9.05	11.25
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value ($US per pound U as UF_6)	1.45	1.50	1.95
Near-Term Uranium Supply[1] (million pounds equivalent U_3O_8)	3.8	5.1	3.8
Near-Term Uranium Demand[2] (million pounds equivalent U_3O_8)	4.5	3.7	1.1
Near-Term Supply-Demand Ratio	0.9	1.4	3.5
Recent Uranium Sales:[3]			
Number of Transactions	8	17	19
Quantity of Material (Million pounds equivalent U_3O_8)	5.2	15.1[4]	7.9
Nuexco SWU Value: ($US per SWU)			
at 0.3 tails assay	50	50	67
US DOE SWU Prices: ($US per SWU)			
USEC	117.85[5]	117.85[5]	117.00[6]
AFC	153.00[7]	153.00[7]	153.00[7]
Requirements	157.00[7]	157.00[7]	157.00[7]
Incentive Price (IP1)	90.00[8]	90.00[8]	90.00[8]
Market Value of Enriched UF_6[9]**:** ($US per kg U as UF_6)			
2.5 w/o U_{235}	267	266	343
3.0 w/o U_{235}	343	342	441
3.5 w/o U_{235}	421	420	542
4.0 w/o U_{235}	500	498	644

[1] Active inquiries to sell, for delivery within 12 months measured from the date of this Report.
[2] Active inquiries to purchase, for delivery within 12 months measured from the date of this Report.
[3] Uranium sales only; does not include loans, conversion, or SWU transactions.
[4] Included 8 transactions concluded prior to February 1, 1990.
[5] Effective 10/1/89 to 9/31/90.
[6] Effective from 10/1/87 to 9/31/89.
[7] Effective since 10/1/84.
[8] Effective from 10/1/86 to 9/31/90, for up to 30% of annual requirements. DOE chose to waive application of the GNP deflator for FY87-FY90 deliveries.
[9] Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

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CURRENT MARKET DATA

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE

Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	11.47	11.58	14.07	29.82	30.10	36.58
Belgium (comm. franc)	306.01	313.27	427.64	795.57	814.44	1,112
Canada (dollar)	10.39	10.52	13.46	27.01	27.34	34.99
EEC (ecu)	7.19	7.28	9.78	18.68	18.94	25.43
Finland (markka)	34.51	35.49	47.82	89.73	92.26	124.33
France (franc)	49.69	51.14	69.39	129.19	132.96	180.41
Italy (lira)	10,860	11,204	15,032	28,234	29,128	39,079
Japan (yen)	1,293	1,286	1,418	3,362	3,343	3,687
Netherlands (guilder)	16.54	16.99	23.04	43.01	44.18	59.60
So. Africa (comm. rand)	22.21	22.55	27.78	57.73	58.62	72.22
Spain (peseta)	944.42	967.11	1,278	2,455	2,514	3,322
Sweden (krona)	53.08	54.90	70.26	138.00	142.73	182.67
Switzerland (franc)	12.91	13.31	17.39	33.55	34.60	45.22
UK (pound)	5.15	5.28	6.44	13.38	13.73	16.74
US (dollar)	8.70	8.85	11.20	22.62	23.01	29.12
West Germany (mark)	14.68	15.06	20.38	38.15	39.16	52.98

TRANSACTION VALUE

Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	11.93	12.10	15.08	31.02	31.46	39.19
Belgium (comm. franc)	318.33	327.43	458.19	827.58	851.25	1,191
Canada (dollar)	10.81	10.99	14.42	28.09	28.58	37.49
EEC (ecu)	7.48	7.61	10.48	19.43	19.79	27.24
Finland (markka)	35.90	37.09	51.24	93.34	96.43	133.21
France (franc)	51.69	53.46	74.35	134.39	138.97	193.29
Italy (lira)	11,297	11,710	16,105	29,370	30,444	41,870
Japan (yen)	1,345	1,344	1,519	3,498	3,494	3,950
Netherlands (guilder)	17.21	17.76	24.69	44.74	46.17	64.18
So. Africa (comm. rand)	23.10	23.57	29.76	60.05	61.27	77.37
Spain (peseta)	982.41	1,011	1,369	2,554	2,628	3,560
Sweden (krona)	55.22	57.38	75.28	143.55	149.18	195.72
Switzerland (franc)	13.43	13.91	18.64	34.90	36.17	48.45
UK (pound)	5.36	5.52	6.90	13.92	14.35	17.93
US (dollar)	9.05	9.25	12.00	23.53	24.05	31.20
West Germany (mark)	15.27	15.74	21.83	39.69	40.93	56.76

[1]Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE

Country (currency)	per lb U as UF_6			per kg U as UF_6		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	1.98	1.96	2.45	4.36	4.33	5.40
Belgium (comm. franc)	52.76	53.10	74.46	116.32	117.06	164.15
Canada (dollar)	1.79	1.78	2.34	3.95	3.93	5.17
EEC (ecu)	1.24	1.23	1.70	2.73	2.72	3.75
Finland (markka)	5.95	6.01	8.33	13.12	13.26	18.36
France (franc)	8.57	8.67	12.08	18.89	19.11	26.64
Italy (lira)	1,872	1,899	2,617	4,128	4,187	5,770
Japan (yen)	222.98	217.96	246.90	491.59	480.52	544.32
Netherlands (guilder)	2.85	2.88	4.01	6.29	6.35	8.84
So. Africa (comm. rand)	3.83	3.82	4.84	8.44	8.43	10.66
Spain (peseta)	162.83	163.92	222.50	358.98	361.37	490.53
Sweden (krona)	9.15	9.31	12.23	20.18	20.51	26.97
Switzerland (franc)	2.23	2.26	3.03	4.91	4.97	6.68
UK (pound)	.89	.89	1.12	1.96	1.97	2.47
US (dollar)	1.50	1.50	1.95	3.31	3.31	4.30
West Germany (mark)	2.53	2.55	3.55	5.58	5.63	7.82

SWU VALUE AND UF_6 VALUE

Country (currency)	SWU Value at 0.30% Tails Assay			UF_6 Value per kg U as UF_6		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	65.92	70.63	84.17	33.28	33.87	42.71
Belgium (comm. franc)	1,759	1,912	2,558	888.14	916.81	1,298
Canada (dollar)	59.70	64.18	80.51	30.14	30.78	40.85
EEC (ecu)	41.30	44.45	58.50	20.85	21.31	29.68
Finland (markka)	198.35	216.54	286.08	100.16	103.85	145.17
France (franc)	285.60	312.07	415.12	144.22	149.67	210.65
Italy (lira)	62,414	68,363	89,921	31,519	32,789	45,631
Japan (yen)	7,433	7,847	8,483	3,754	3,763	4,305
Netherlands (guilder)	95.08	103.69	137.83	48.01	49.73	69.94
So. Africa (comm. rand)	127.62	137.58	166.17	64.44	65.98	84.32
Spain (peseta)	5,428	5,901	7,645	2,741	2,830	3,880
Sweden (krona)	305.06	334.99	420.33	154.05	160.66	213.29
Switzerland (franc)	74.17	81.22	104.05	37.45	38.95	52.80
UK (pound)	29.59	32.22	38.52	14.94	15.45	19.54
US (dollar)	50.00	54.00	67.00	25.25	25.90	34.00
West Germany (mark)	84.35	91.91	121.91	42.59	44.08	61.86

[1]Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

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NUEXCO Monthly Report

April 1990
No. 260

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To Our Readers

The 1989 Annual Review will be mailed to our subscribers this month. This special report summarizes 1989 nuclear fuel industry activities during 1989, and analyzes developments in the spot and long-term uranium and enrichment markets. The NUEXCO Market Values for 1989 are also reprinted in a series of tables for your reference.

If you would like to purchase additional copies of the 1989 Annual Review, please contact Lori Mattics in our Denver office at (303) 899-4500.

* * *

In the March 1990 Monthly Report (No. 259), the *Market Values Expressed in Selected Currencies* tables shown on page six and seven contained numerous data entry errors in the columns labled "12 Months Ago (Feb 28, 1989)". Corrected versions of these tables are included as inserts this month. We regret any inconvenience to our subscribers.

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MARKET VALUES SUMMARY
March 31, 1990

Market Values	This Month (Report 260)	Active Supply* (thousand pounds equivalent U_3O_8)	Active Demand* (thousand pounds equivalent U_3O_8)
EXCHANGE VALUE [1]	$8.80/lb U_3O_8	3,840**	2,470**
UF_6 VALUE [2]	$24.40/kg U as UF_6		
LOAN RATE [3]	3.5%/annum	6,270	0
CONVERSION VALUE [4]	$1.45/lb U as UF_6	550	0
SWU VALUE [5] 0.3 tails assay:	$50/SWU	345	95
TRANSACTION VALUE [6]	$8.75 Per Pound U_3O_8	13 Transactions	3 Months	4.4 Million Pounds

* Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

** Includes uranium concentrates and uranium hexafluoride.

DEFINITIONS

[1] The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

[2] The **UF_6 Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

[3] The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

[4] The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

[5] The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

[6] The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
b. At least ten transactions;
c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

DERIVATIONS AND COMMENTS

- All **Market Values** are based on:
  - Data from recently completed transactions.
  - Data from pending transactions.
  - Firm bids to buy or borrow, and firm offers to sell or lend.
  - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.
- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.
- In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U^{235} and a product assay of 3.0 weight-percent U^{235}, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.
- In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.
- The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

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PRICING

MARCH MARKET REVIEW

(as of March 31, 1990)

NATURAL URANIUM AND CONVERSION

Short-term Market Activity

In a very active month, the Exchange Value increased for the first time since October 1987. Over five million pounds equivalent U_3O_8 changed hands this month in eight near-term sales. One involved natural uranium concentrates, four involved natural UF_6, and five involved enriched uranium product (EUP). Two transactions involved the sale of both natural UF_6 and UF_6 contained in EUP.

The **Exchange Value** rose $0.10 to **$8.80** per pound equivalent U_3O_8. This marks the first time in 29 months that the Exchange Value has increased. One March concentrates sale occurred at an even higher level, but it included special timing considerations. Near-term supply of concentrates has declined in recent months, and near-term demand has increased, so that Active Demand exceeded Active Supply by 700 thousand pounds equivalent U_3O_8 on March 31. Early in March some material was available at $8.70 per pound, but more recently, prices for natural uranium concentrates have firmed somewhat, and supplies have not been available for sale at that price level.

Namibia became an independent nation on March 21; President Bush immediately lifted US sanctions against imports of Namibian-origin material, and Canada lifted its ban on new contracts for conversion of Namibian material. Although Rössing management has indicated it will not participate in the spot market at current prices, it represents a new source of long-term concentrates supply in markets such as the USA and Canada, which have been closed to Rössing for more than three years. Rössing produced approximately eight million pounds equivalent U_3O_8 in 1989, but has the ability to increase its output by 25 percent in 1990 and beyond.

The **UF_6 Value** dropped to **$24.40** per KgU as UF_6, down $0.85 from February 28, 1990. The substantial available quantities of UF_6 and vigorous efforts to stimulate sales continued to exert downward price pressure during March. Seven near-term UF_6 sales are reported for March; four involved natural UF_6 and five involved EUP. (The seven sales included two sales that involved both natural UF_6 and UF_6 contained in EUP.) One of the sales involved the liquidation of fabricated fuel by Sacramento Municipal Utility District (SMUD), owner of the closed Rancho Seco unit. The seven sales totalled over five million pounds equivalent U_3O_8.

As is customary in the nuclear fuel market, variations in origin, timing, location, and form all affected the final prices in specific sales, especially during March. Utilities, producers, fabricators, and intermediaries all participated in the market as both buyers and sellers this past month. This development, regardless of traditional roles, has become common practice in the uranium market.

* * *

The **Transaction Value** fell to **$8.75** per pound equivalent U_3O_8 based on 13 transactions over 3 months involving 4.4 million pounds. This is the first time since April 30, 1986 that the Transaction Value has fallen below the Exchange Value. Since the Transaction Value always lags the Exchange Value, it is customary for the Transaction Value to continue downward when the Exchange Value first moves upward after a sustained decline.

* * *

Active Supply of uranium concentrates fell to **3.8** million pounds equivalent U_3O_8, down from the February 28, 1990 level of 5.1 million pounds. In the near term, supplies of concentrates are substantially below levels of a few months ago (especially if buyers restrict origin, form, or location requirements), but the shortage is temporary. Meanwhile, supplies of UF_6 and EUP remain plentiful.

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Active Demand increased again this month to **4.5** million pounds equivalent U_3O_8. The majority of this demand comes from producers, both to satisfy current contract commitments and for discretionary purchases to inventory.

The **Supply/Demand Ratio** declined to **0.9**, marking the first time in over ten years it has fallen below 1.0. On November 30, 1982, Active Demand equaled Active Supply, but otherwise the Supply/Demand Ratio has always been larger than 1.0. This development tends to support the small upswing in the Exchange Value. However, material available for loan exceeded 6.2 million pounds equivalent U_3O_8, of which, up to 5.0 million pounds are available in the form of concentrates. This material could easily offset the current supply tightness in the concentrates market.

One US utility has recently solicited offers for concentrates, and is expected to make a decision in April. Cameco, the world's largest uranium producer, has been an active buyer in recent months, and is again seeking to purchase concentrates on the spot market.

* * *

Natural Uranium Long-term Activity

The long-term natural uranium market remained fairly active this month. Five long-term sales totalling nearly eight million pounds equivalent U_3O_8 are reported. Four of the transactions concluded sales of concentrates under market-related pricing terms. In the fifth long-term sale, an intermediary sold UF_6 to a utility at a series of fixed prices.

* * *

The **Loan Rate** remained at **3.5** percent per annum. Five loans are reported this month at or near the March 31, 1990 Loan Rate. These loans included nearly 1.6 million pounds equivalent U_3O_8. Intermediaries borrowed the material in all five of these transactions from four utilities and one producer. One loan involved UF_6; the remaining four involved concentrates. Loan supply is abundant and accessible at current market levels. Lenders willing to accept less restrictive origin returns and flexible repayment terms have been the most attractive to borrowers.

The **Conversion Value** slipped to **$1.45** per pound U as UF_6. Little active demand for conversion exists at present. Two conversion transactions totalling over 600 thousand pounds U as UF_6 took place at price levels above the March 31, 1990 Conversion Value. Nevertheless, the availability of UF_6, and the divergence between the UF_6 Value and the sum of the Exchange and Conversion Values, is putting substantial downward pressure on the Conversion Value. If that continues during April, further price slippage seems likely.

ENRICHMENT SERVICES

The **SWU Value** remains unchanged at **$50** per SWU. This report notes six near-term sales involving nearly 500 thousand SWU. Four of the sales involved enriched UF_6; the natural UF_6 component of such sales is discussed under uranium sales. There are no long-term enrichment transactions reported, although during March a number of utilities entered the market to fill medium- and long-term SWU needs and are currently evaluating offers. Other utilities will be entering the market in the next few months.

When several utilities liquidated their enriched UF_6 stockpiles during the first quarter of this year, it put substantial downward pressure on SWU prices. However, unless new supplies enter the market soon, prices could move upward, particularly in light of new intermediate-term demand and the reluctance of primary suppliers to sell at current price levels. ■

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CURRENT MARKET DATA

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE

Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	11.70	11.47	13.12	30.41	29.82	34.11
Belgium (comm. franc)	309.10	306.01	425.79	803.58	795.57	1,107
Canada (dollar)	10.31	10.39	12.78	26.81	27.01	33.23
EEC (ecu)	7.32	7.19	9.70	19.04	18.68	25.23
Finland (markka)	35.29	34.51	45.67	91.74	89.73	118.73
France (franc)	50.25	49.69	68.72	130.63	129.19	178.66
Italy (lira)	11,011	10,860	14,915	28,626	28,234	38,776
Japan (yen)	1,377	1,293	1,427	3,579	3,362	3,711
Netherlands (guilder)	16.82	16.54	22.94	43.72	43.01	59.64
So. Africa (comm. rand)	23.33	22.21	27.39	60.65	57.73	71.20
Spain (peseta)	956.11	944.42	1,268	2,486	2,455	3,297
Sweden (krona)	53.95	53.08	69.21	140.27	138.00	179.93
Switzerland (franc)	13.17	12.91	17.79	34.23	33.55	46.24
UK (pound)	5.38	5.15	6.38	13.99	13.38	16.60
US (dollar)	8.80	8.70	10.70	22.88	22.62	27.82
West Germany (mark)	14.93	14.68	20.35	38.82	38.15	52.89

TRANSACTION VALUE

Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	11.63	11.93	13.80	30.24	31.02	35.86
Belgium (comm. franc)	307.34	318.33	447.67	799.02	827.58	1,164
Canada (dollar)	10.26	10.81	13.44	26.66	28.09	34.94
EEC (ecu)	7.28	7.48	10.20	18.93	19.43	26.53
Finland (markka)	35.09	35.90	48.02	91.22	93.34	124.83
France (franc)	49.96	51.69	72.25	129.89	134.39	187.84
Italy (lira)	10,948	11,297	15,682	28,464	29,370	40,769
Japan (yen)	1,369	1,345	1,501	3,559	3,498	3,902
Netherlands (guilder)	16.72	17.21	24.12	43.47	44.74	62.71
So. Africa (comm. rand)	23.20	23.10	28.79	60.31	60.05	74.86
Spain (peseta)	950.67	982.41	1,333	2,472	2,554	3,466
Sweden (krona)	53.65	55.22	72.77	139.47	143.55	189.18
Switzerland (franc)	13.09	13.43	18.70	34.03	34.90	48.62
UK (pound)	5.35	5.36	6.71	13.91	13.92	17.45
US (dollar)	8.75	9.05	11.25	22.75	23.53	29.25
West Germany (mark)	14.85	15.27	21.39	38.60	39.69	55.61

[1]Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

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CONVERSION VALUE

Country (currency)	per lb U as UF_6			per kg U as UF_6		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	1.93	1.98	2.39	4.25	4.36	5.27
Belgium (comm. franc)	50.93	52.76	77.60	112.28	116.32	171.07
Canada (dollar)	1.70	1.79	2.33	3.75	3.95	5.14
EEC (ecu)	1.21	1.24	1.77	2.66	2.73	3.90
Finland (markka)	5.81	5.95	8.32	12.82	13.12	18.35
France (franc)	8.28	8.57	12.52	18.25	18.89	27.61
Italy (lira)	1,814	1,872	2,718	4,000	4,128	5,992
Japan (yen)	226.85	222.98	260.14	500.11	491.59	573.51
Netherlands (guilder)	2.77	2.85	4.18	6.11	6.29	9.22
So. Africa (comm. rand)	3.84	3.83	4.99	8.47	8.44	11.00
Spain (peseta)	157.54	162.83	231.10	347.32	358.98	509.48
Sweden (krona)	8.89	9.15	12.61	19.60	20.18	27.81
Switzerland (franc)	2.17	2.23	3.24	4.78	4.91	7.15
UK (pound)	.89	.89	1.16	1.95	1.96	2.56
US (dollar)	1.45	1.50	1.95	3.20	3.31	4.30
West Germany (mark)	2.46	2.53	3.71	5.42	5.58	8.17

SWU VALUE AND UF_6 VALUE

Country (currency)	SWU Value at 0.30% Tails Assay			UF_6 Value per kg U as UF_6		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	66.47	65.92	82.16	32.44	33.28	40.46
Belgium (comm. franc)	1,756	1,759	2,666	857.04	888.14	1,313
Canada (dollar)	58.60	59.70	80.04	28.60	30.14	39.42
EEC (ecu)	41.61	41.30	60.77	20.31	20.85	29.92
Finland (markka)	200.50	198.35	285.96	97.84	100.16	140.84
France (franc)	285.50	285.60	430.31	139.33	144.22	211.94
Italy (lira)	62,563	62,414	93,393	30,531	31,519	45,999
Japan (yen)	7,822	7,433	8,938	3,817	3,754	4,402
Netherlands (guilder)	95.55	95.08	143.65	46.63	48.01	70.75
So. Africa (comm. rand)	132.56	127.62	171.49	64.69	64.44	84.46
Spain (peseta)	5,432	5,428	7,940	2,651	2,741	3,911
Sweden (krona)	306.56	305.06	433.38	149.60	154.05	213.45
Switzerland (franc)	74.81	74.17	111.37	36.51	37.45	54.85
UK (pound)	30.57	29.59	39.98	14.92	14.94	19.68
US (dollar)	50.00	50.00	67.00	24.40	25.25	33.00
West Germany (mark)	84.83	84.35	127.40	41.40	42.59	62.74

[1]Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

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CURRENT MARKET DATA

RECENT TRANSACTIONS

URANIUM SALES[1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U_3O_8)	Approximate Price Range[2] as Percent of Current Exchange Value or UF_6 Value	Buyer	Seller	Remarks
4772A	1990	601-1,000	R[3]	Intermediary	Utility	Contained in EUP
4776A	1990	100-300	R[3]	Utility	Intermediary	Contained in EUP
4780A	1990	1,001-3,000	See Remarks	Utility	Fabricator	UF_6 and EUP/Price Related To Market
4781A	1990	1,001-3,000	R[3]	Fabricator	Utility	UF_6 and EUP
4782A	1990	101-300	R[3]	Utility	Fabricator	Contained in EUP
4783	1990	301-600	98-102	Utility	Intermediary	UF_6
4786	1992-97	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated
4787	1993-97	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated
4788	1990	101-300	98-102	R[3]	Intermediary	UF_6
4791	1990	101-300	98-102	Producer	Intermediary	
4792	1991-96	3,001-6,000	R[3]	R[3]	R[3]	
4793	1990-92	301-600	See Remarks	Utility	Intermediary	UF_6/Series of Fixed Prices
4794	1992-97	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated

[1] Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

[2] The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation **R** means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

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NATURAL URANIUM LOANS[1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U_3O_8)	Approximate Price Range[2] as Percent of Current Loan Rate	Borrower	Lender	Remarks
4764	1990	301-600	98-102	Intermediary	Utility	
4777	1990	101-300	98-102	Intermediary	Producer	
4778	1990	101-300	98-102	Intermediary	Utility	
4784	1990	101-300	98-102	Intermediary	Utility	
4795	1990	301-600	98-102	Intermediary	Utility	UF_6

CONVERSION SERVICES SPOT MARKET SALES[1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds U as UF_6)	Approximate Price Range[2] as Percent of Current Conversion Value	Buyer	Seller	Remarks
4789	1990	101-300	103-107	Utility	Intermediary	
4790	1990	301-600	108-112	Utility	Converter	

ENRICHMENT SERVICES SECONDARY MARKET SALES[1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity[4] (thousand SWUs)	Approximate Price Range[2] as Percent of Current SWU Value[5]	Buyer	Seller	Remarks
4772B	1990	101-300	R[3]	Intermediary	Utility	Contained in EUP
4776B	1990	50-100	R[3]	Utility	Intermediary	Contained in EUP
4780B	1990	50-100	See Remarks	Utility	Fabricator	Price Related To Market
4781B	1990	101-300	R[3]	Fabricator	Utility	Contained in EUP
4782B	1990	Less Than 50	R[3]	Utility	Fabricator	Contained in EUP
4785	1990	50-100	98-102	Utility	Intermediary	

[1] Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

[2] The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

[3] The notation **R** means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

[4] If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay.

[5] Prices are usually normalized to 0.30% tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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CURRENT MARKET DATA

URANIUM SUPPLY
(March 31, 1990)

NUEXCO Project Number	Delivery Period[1] (Thousand Pounds of U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
89-1001	1,300	1,300 per year	1990-93, UF_6
89-1201	2,000	3,000 per year	1990-93
89-7000A	500	—	1990, UF_6
90-1051*	40	—	1990, UF_6
90-1027	—	300 per year	1991-2000
Total	**3,840**		
INACTIVE			
89-1076	500	250 per year	1990 on
89-1156	200	—	1990
89-1173	750	—	1990
89-1180	1,000	—	1990
89-1209	400	400 per year	1990-93
90-1000A	655	—	1990, UF_6e
87-1000	—	600 per year	1991-95
87-1123	—	1,000 per year	1990 on
88-1157	—	1,000 per year	1990 on, UF_6
Total	**3,505**		

* New or revised since last month.

[1] Measured from the date of this Report.
[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 88-1096A, 89-1128, 89-1252.

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URANIUM DEMAND
(March 31, 1990)

NUEXCO Project Number	Delivery Period [1] (Thousand Pounds of U_3O_8) Spot or Near-term [2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
89-1183	400	—	1990
89-1229	100	—	1990
90-1026	100	—	1990
90-1034	300	—	1990
90-1038*	800	—	1990
90-1045A	405	—	1991, UF_6e
90-1046	600	—	1990
90-1060*	200	—	1990
90-1064*	650	—	1990, UF_6
90-1067*	500	600 per year	1990-96
90-1069*	75	—	1990, U_3O_8/UF_6e
90-1074*	340	—	1990
89-1233	—	160	1991, UF_6
89-1254	—	270 per year	1991-2000
89-1256	—	200 per year	1991-94
89-1260	—	250 per year	1992-94
90-1024	—	250 per year	1992-2001
Total	**4,470**		
INACTIVE			
89-1067	**500**	**—**	**1990**
89-1175	**170**	**170 per year**	**1990-91**
90-1001	**350**	**—**	**1990**
90-1008	**130**	**—**	**1990**
90-1017*	**—**	**500**	**1991**
Total	**1,150**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 89-1090, 90-1019A, 90-1020A, 90-1048.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(March 31, 1990)

NUEXCO Project Number	Delivery Period[1] (Thousand Pounds of U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
88-1182	4,000	—	U_3O_8/UF_6
90-1016	300	—	U_3O_8
90-1031	500	—	U_3O_8
90-1033	1,270	—	UF_6
90-1036*	200	—	U_3O_8
Total	**6,270**		

INACTIVE

None reported

Inquiries to Borrow:

No inquiries to borrow are reported

* New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 89-1225, 90-1041.

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CONVERSION SUPPLY AND DEMAND
(March 31, 1990)

NUEXCO Project Number	Delivery Period[1] (Thousand Pounds of U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
89-7000C	400	—	
89-7002	150	—	
Total	**550**		
INACTIVE			
None reported			
Inquiries to Purchase			
ACTIVE			
No inquiries to purchase are reported			
INACTIVE			
None reported			

* New or revised since last month.
[1] Measured from the date of this Report.
Projects removed since last month: 89-7001A, 90-1028, 90-1040.

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CURRENT MARKET DATA

SWU SUPPLY AND DEMAND
(March 31, 1990)

NUEXCO Project Number	Delivery Period [1] (Thousand SWUs) Spot or Near-term [2]	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
88-1082	100	—	1990
89-7000B	100	—	1990
90-1073*	145	—	1990
Total	**345**		
INACTIVE			
88-1210	200	200 per year	1990-93
90-1000B	150	—	1990, UF6e
Total	**350**		
Inquiries to Purchase			
ACTIVE			
90-1045B	95	—	1991, UF6e
88-1061	—	500	1991-95
89-1262	—	120 per year	1996-99
90-1022A	—	235 per year	1996-99
90-1022B	—	900 per year	2000-13
90-1035*	—	300 per year	1996-2000
90-1052*	—	280 per year	1996-on
90-1071*	—	150 per year	1992-94
Total	**95**		
INACTIVE			
89-1043	50	—	1990
89-1047	—	600	1991-95
Total	**50**		

* New or revised since last month.

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

Projects removed since last month: 88-1096B, 89-7001B, 90-1019B, 90-1020B, 90-1032.

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RECENT DEVELOPMENTS

USCEA Fuel Cycle '90 Conference

At the US Council for Energy Awareness Fuel Cycle '90 Conference in Nashville, Tennessee, held March 25-28, discussions centered on the many changes occurring in the industry, particularly regarding increased internationalization of suppliers. The fuure of the enrichment market held a prominent place in conversation, as participants speculated about the future of DOE, Louisiana Energy Services (LES), the possibility of an Australian enrichment plant, and Technsnabexport's growing role in the marketplace. Summaries of some of the papers presented at the conference follow.

THE CHANGING NUCLEAR FUEL INDUSTRY

NRC Licensing

Forrest J. Remick of the Nuclear Regulatory Commission (NRC) discussed the progress of NRC licensing. The one-step license process, which provides for a combined construction and operating license, is expected to provide stability to the nuclear industry by requiring a hearing on the completed design and allowing for public participation prior to the start of construction. Provided the licensee builds the plant according to the license, the plant will be allowed to operate. In answer to a question from William D. Magwood of the Edison Electric Institute, Commissioner Remick stated that this type of license should reduce the effectiveness of delay tactics used by antinuclear groups.

US National Energy Strategy

Assistant Secretary for Nuclear Energy, William H. Young, referring to the National Energy Strategy, stated that DOE's major objective is an open and informed national consensus for a secure, sensible energy future. He encouraged vocal participation in turning around public attitudes about nuclear power, and anticipates restoring viability to the uranium industry by the end of the 1990s. He also expects to see new plants operational by the late 1990s. All of this is subject, however, to the resolution of several issues, including restoring public confidence in nuclear power by:

- demonstrating attention to safety, environmental protection, and enhanced operational performance;
- improving the economics of nuclear power through restructuring of the uranium enrichment enterprise and deployment of AVLIS;
- demonstrating significant progress on nuclear waste disposal.

In response to questions from attendees, Mr. Young stated that DOE is also planning to improve the domestic uranium mining industry by attracting foreign buyers to purchase domestic uranium. Although DOE is primarily involved in the US National Energy Strategy, it very strongly supports participation in international discussions on worldwide energy issues, including global warming.

TVA's Nuclear Program

Tennessee Valley Authority's Oliver D. Kingsley, Jr., discussed the progress of TVA's nuclear program, and pointed out that the company had succeeded in stabilizing rates and reducing overhead through careful planning. Its goals for 1990 include the restart of Unit 2 at Browns Ferry and plans to make significant progress towards startup of Watts Bar Unit 1.

Internationalization of the Nuclear Fuel Industry

Richard J. Sills of British Nuclear Fuels, plc. (BNFL) explored the issue of internationalization of the nuclear fuel industry. Clients and industry can realize many benefits through shared technology. Information on technology, cost estimation, construction, and scheduling performance can be made available to the USA through acquisitions, mergers, joint ventures, and teaming. LES is an example of such cooperation and collaboration. By integrating their information and methodologies, companies are able to reduce the risk of new ventures.

Congress and Nuclear Energy

The industry needs communicators and public understanding, according to US Senator Jim McClure of Idaho. "There is growing confidence in this prolonged era of economic expansion but we need to have confidence in the future as well." Senator McClure believes Congress should be concerned about global environmental impacts such as global warming and high-level waste disposal, but should emphasize solutions for domestic energy and environmental problems, then pursue international issues.

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RECENT DEVELOPMENTS

URANIUM ACTIVITIES

Preliminary EIA 1989 Market Data

Howard L. Walton's report on the Energy Information Administration's preliminary uranium market data for 1989 notes that between 1980 and 1989 Canada's world market share increased from 16 to 32 percent. During the same time, Australia's world share more than doubled from 4 to 10 percent, while the US share declined from 38 to 15 percent. The current decline in the spot market price has contributed to prices for material delivered under long-term contracts falling from $25.65 per pound in 1988 to $19.43 per pound in 1989.

US commercial inventory levels declined by 15 percent from 1988 to 1989, and unfilled requirements for the next ten years increased by 35 million pounds in 1989. For 1992, US utilities report over 11 million pounds of uncommitted demand, increasing to over 30 percent of their requirements uncommitted by 1993. Mr. Walton added that many utilities are completely uncommitted in the late 1990s.

Spot vs. Long-Term Contracting

In attempting to answer the questions, "Where is it all coming from?" and "When will it end?", James J. Graham, President and CEO of Total Minerals Corporation (Total), discussed long-term contracting versus the spot market. Although Total prefers to sell under long-term contracts, the company is equally amenable to selling on the spot market, provided such sales provide the returns required by the corporation. Total believes a larger spot market would reduce the influence of any one particular group. It also feels this would result in more sales between principals and reduce dependence on intermediaries.

Arizona Public Service Procurement Strategy

Paul F. Crawley of Arizona Public Service Company (APS) described the company's philosophy on uranium contracting, which is similar to many others in the industry. APS does not rely completely on the spot market, but satifies approximately 75 percent of its projected needs under long-term contracts with minimum commitments, flexible terms, and price protection in the form of ceiling prices. APS has diversified its uranium contracting to include nine contracts with seven suppliers and a variety of pricing terms. The company is fully covered with firm commitments through 1997, and with optional coverage through the year 2000. APS has made three spot market purchases over the past three years. It plans to apply this strategy to all components of the fuel cycle, and has taken initial steps towards applying it to UF_6 and conversion.

The Long and Short of It

George White, Jr. of NUEXCO, reports that although the market may appear to be changing dramatically, it has really not changed much at all. For example, the NUEXCO Exchange Value reached an all-time low (adjusted for inflation) on February 28, 1990, record quantities of uranium are moving through the spot market, broker/traders are becoming increasingly active in the marketplace, and major restructuring is taking place in the uranium production industry. Nevertheless, inventory remains the key player in the marketplace.

The one element that has consistently affected the market is the level and usage (or non-usage, as the case may be) of utility and producer inventories. It has had a resounding effect on both the spot market and the long-term market. As inventories are moved and traded, increased and decreased, the spot price has declined. Until excess inventories are absorbed, no real price recovery is possible. In his closing statement he summarizes, "Neither the general situation nor this particular message has changed much during the past several years. What has changed, or should have changed, is our recognition of the situation—specifically, that the rationalization of the uranium market is proving to be a longer rather than a shorter process." (Mr. White's speech is reprinted on page 21.)

Liability of Shipping Radioactive Materials

Robert L. Bovey of NuTranS, spoke about the potential liability of shipping radioactive materials. Although the industry maintains an excellent safety record, it is important to fully understand one's particular insurance needs and how they work—before an accident occurs. Mr. Bovey examined the potential for even remote parties to be included in a lawsuit to reclaim damage for personal injury or property damage, as well as cleanup and environmental restoration, emergency forces actions, legal fees, and fines. He discussed the cost implications and suggested that managers evaluated on their cost containment performance may not use the proper insurance in an effort to enhance their performance appraisals. Mr. Bovey emphasized that the best protection is to be familiar with your entire policy and verify that your perceived and actual coverage are the same. (Mr. Bovey's speech is reprinted on page 25.)

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ENRICHMENT ACTIVITIES

TECHSNABEXPORT (TENEX)

Mr. Alexander G. Chernov, Deputy Director General of Techsnabexport (TENEX), presented an overview of the Soviet Union's activities in uranium and uranium enrichment. He noted that because of the hign purity of the uranium oxides processed, the technology for processing uranium/fluorine compounds or metallic uranium is greatly simplified. He also explained that Soviet gas centrifuges operate very reliably, and provided background on TENEX contracting activities. In the early 1970s, the organization began its marketing effort, excuting agreements to supply enrichment to almost all West European countries. Most of these contracts are still in place today, extending through 2000 or even 2010. Mr. Chernov was quick to point out that TENEX contracts are not standardized and that each is individually tailored to meet the needs of its customers. Since 1988, TENEX has been shipping enriched uranium product. It has the capability to export up to three million SWU annually, and the potential for more. TENEX is prepared to supply both long-term and short-term contracts for natural or enriched uranium, and is eager to participate in the enrichment market.

AVLIS Demonstration and Deployment

Philip G. Sewell (DOE) summarized the AVLIS Demonstration and Deployment Plan submitted to Congress in January, and requested that utilities participate in the legislative process of restructuring, licensing, and AVLIS deployment. He stated that "the future is now, the choice is yours, and if you sit back and watch you won't be happy with the outcome." In response to a question of whether the demonstration report due September 1992 would identify costs, Sewell's response was that it should form the foundation from which to offer new contracts and determine enrichment prices. Regarding the timetable under which Congress must act in order for DOE to maintain its schedule, Sewell explained that the plan identifies activities in 1990, 1991, and 1992. Congress has already appropriated money for FY1990 and will be acting on legislation appropriating money for FY1991. Preliminary indications are that they will appropriate the monies necessary.

For a question on how the electricity consumption compares between AVLIS and the existing gaseous diffusion plants, Mr. Sewell's answer was "very close; power costs should be comparable." When asked whether DOE would pursue dumping action against TENEX, Mr. Sewell stated he was unable to answer. Later during the session he indicated that DOE wants to explore the possibility of private entities willing to invest in AVLIS.

LES Progress

W. Howard Arnold reported on the progress of Louisiana Energy Services (LES). The fonnal partnership agreement is nearly finalized, and an agreement between the four governments involved in importing software and hardware (under development since the middle of 1989) is expected to be signed in April. The partners are working in parallel on several other issues, including purchasing the plant site (approximately 450 acres in Northwestern Louisiana near the towns of Homer and Haynesville), and licensing under parts 40 and 70 of the Atomic Energy Act rather than under part 50. LES will submit its license application in January 1991, and expects to receive the license around the end of 1992. Production is scheduled to begin in 1996, so LES is targeting this date for delivery under new contracts. When asked why LES was investing in an oversupplied industry, with slow growth and high costs, Mr. Arnold's response was, "Can the new plant provide a return on investment? The answer is a resounding yes."

A Utility Perspective on Enrichment

A utility perspective on new enrichment technologies was provided by Andrew F. Yaros of Virginia Power Co. (VEPCO). VEPCO believes that new technologies are important because they provide a source of competition, improve market efficiency, and provide potential for reduced costs. The company is optimistic about CRISLA (Chemical Reaction by Isotope Selective Laser Activation), centrifuge technology, and existing GDPs. However, VEPCO seriously doubts AVLIS's ability to compete in the future market. When asked how much supply he thought US utilities would purchase from TENEX, Mr. Yaros said "that, based on DOE's proposal to get money to buy alternative supply, we may all get TENEX SWU's."

Enrichment in Australia

Although Michael P. Goldsworthy is convinced that Australia should enter the enrichment market in the 1990s, his fellow countrymen are not sure. Mr. Goldsworthy stated that one individual even requested that he withdraw his paper. While he was very optimistic, Mr. Goldsworthy acknowledged that Australia does not have the technical expertise for such a venture and would have to rely on technology transfers from other countries.

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Isotope Technologies

In a question and answer period near the end of the session, Mr. Yaros asked a question to the session chairman, John Longenecker, President and CEO of Isotope Technologies, Inc. (ITI), about why and how ITI planned to compete in the enrichment market. Mr. Longenecker responded that ITI is pursuing it for three reasons:

- low capital costs
- low operational costs
- simple hardware

He also added that ITI has private funding and is starting out on a small scale.

HIGH-LEVEL WASTE AND TRANSPORTATION

The session on high-level waste and transportation centered around the problems DOE has had meeting the scheduled deadline for receiving fuel and the plan for interim storage (Monitored Retrievable Storage). All speakers emphasized the importance of identifying a realistic plan and corresponding schedule and meeting each of the targets on time. The recent lawsuit brought by the Department of Justice against the State of Nevada could adversely affect the program. According to C. Frederick Sears of Northeast Utilities, some Public Utility Commissions appear to be reconsidering the entire program. US utilities have contributed over $4 billion to the Nuclear Waste Fund, but DOE has yet to demonstrate that a repository (temporary or permanent) will be available by 1998 as scheduled.

FUEL CYCLE ISSUES

The final session of the conference covered EPA radionuclide standards and amendments to the Clean Air Act, as well as trends in fuel fabrication. Lucinda L. Swartz of the Senate Environment and Public Works Committee said that "regulation under both the Atomic Energy Act and Clean Air Act is burdensome, wasteful, and unnecessary. Dual regulation is costly and does not provide any additional protection for the public."

John O'Neill, Jr. warned fuel buyers to beware of the typical or standardized ("boiler plate") fuel procurement contracts. He advised listeners to use caution with contracts that do not adequately address issues such as unforeseen events (force majeure), limits of liability, warranties, government law, and resolution of disputes. ■

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WASHINGTON FOCUS

Congress devoted much of March to discussion of amending the Clean Air Act, postponing action on other issues such as the budget for FY1991. On April 3, for the first time since enactment of the original Clean Air Act of 1970, the Senate voted 89 to 11 to tighten emission standards. The House Energy & Commerce Committee is hard at work on its version of a Clean Air bill. The Department of Energy released its draft National Energy Strategy, with "energy efficiency" as its major theme. The draft examines various options on the supply and demand side of the energy equation. It also covers a range of options, including nuclear energy, but makes no choices or recommendations. DOE will adjust its budgetary framework for FY1992 to reflect the options selected from the report. The White House is expected to release the final report sometime in 1991.

Radionuclide Emissions Regulations

Prior to final passage of the Clean Air Act, Sen. Alan Simpson (R-WY) offered a new amendment that would exempt the EPA from setting radionuclide emissions standards for facilities already licensed by the NRC unless the EPA Administrator found that the NRC regulations "do not provide an ample margin of safety to protect the public health." This latest amendment was approved when a motion to table failed by a vote of 33 to 67. An amendment offered earlier in March to prevent this dual regulation had failed after it became a battle over states' rights.

On March 21, the EPA announced a 120-day stay of the section of its final radionuclides rule that applies to companies already regulated by the NRC. Petitions from the nuclear industry contesting the dual regulation set forth by the Atomic Energy Act were filed with the D.C. Circuit Court, enabling EPA to issue the stay. EPA will continue to analyze these comments for reconsideration of the final rule. The regulations, published December 15, 1989, were to have gone into effect March 15.

LES Licensing Procedures

The House Interior and Insular Affairs Committee held a hearing March 6 on licensing requirements for private uranium enrichment facilities [specifically, for Louisiana Energy Services (LES)], and reviewed a Senate amendment to a public lands bill that would place enrichment facilities under the same licensing requirements as a materials processing facility. Sen. J. Bennett Johnston (D-LA), representing the state in which the plant will be built, spoke about the dire economic effects of a delay in licensing, and explained the differences between enrichment plants and nuclear power plants. Following his testimony, Committee members agreed that enrichment plants and nuclear power plants should have different licensing requirements. Rep. George Miller (D-Calif) expressed his belief that an Environmental Impact Statement (EIS) should be prepared prior to licensing, and that adequate public hearings should be conducted. He added that licensing issues should be addressed before the onset of construction.

Sanctions Against Namibia Lifted

President Bush issued a March 21 statement revoking anti-apartheid sanctions against Namibia and establishing diplomatic relations with the newly-independent nation. The President noted, "We welcome Namibia as a full trading partner and are taking steps to ensure that it is given access to the American market."

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RECENT DEVELOPMENTS

Downwinders Trust Fund

The House Judiciary Committee approved H.R. 2372, which would establish a $100 million trust fund to compensate uranium miners and citizens in Arizona, Colorado, New Mexico, Nevada, and Utah who were exposed to fallout from the Nevada test site. The "downwinders" legislation establishes a $100,000 compensation cap for each uranium miner, and $50,000 for each affected citizen.

Mill Tailings Lawsuit

The US Court of Appeals for the Federal Circuit upheld a lower court ruling that dismissed the lawsuit brought by eight uranium mining companies against the federal government over cleanup responsibility of old mill sites. The miners asserted that the government was responsible, since all uranium produced between 1950 and 1970 from the subject mill sites was under contract to the Atomic Energy Commission. At that time, the expense of tailings cleanup was not foreseen, and was not included in the supply contracts. The Court found that the 1978 Uranium Mill Tailings Radiation Control Act (UMTRCA) effectively placed the burden of environmental cleanup on producers, and that the government had no contractual responsibility for these sites.

Proposed EPA Elevation

Legislation first introduced January 23 elevating the EPA to a cabinet level department has reached both the Senate and House floors for action. The House Government Operations Committee approved H.R. 3847 in mid-March, which would create a Department of Environmental Protection. Elevating the importance of the EPA would indicate support for the growing environmental movement. A new Department of Environmental Protection could take over the NRC's environmental responsibilities. ■

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INDUSTRY BRIEFS

Soviet Union to Build Iran Nuclear Plant

The Soviet Union signed an agreement on March 6 to build two 440-MWE nuclear power plants in Iran, as well as assist in the completion of the Bushehr reactors on which construction was suspended following the revolution. In partial payment, Iran will annually export over 100 billion cubic feet of natural gas to the Soviet Union.

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Denison Announces Cuts In Elliot Lake Production

Denison Mines Ltd. announced that by August it will reduce annual Elliot Lake production to 2.7 million pounds equivalent U_3O_8, compared to the previous rate of 4.3 million pounds. This 37% reduction will result in the elimination of 450 jobs.

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Soviet Environmental Study Delays Rostov Startup

The startup has been delayed for the Soviet Union's first nuclear reactor at the Rostov station due to a pending environmental impact study. A decision on whether to star up the VVER-1000 unit located near Volgodonsk will be made this fall.

Cogema Closes Two Mines, Others To Follow

Cogema has closed its Ecarpière uranium mine at Getigne and suspended activities at Piriac, due to high extraction costs. The Chardon-en-Loire and La Commanderie operations will be closed by 1991, and the concentrate plant operated by Cogema's subsidiary, Société Industriele des Minerais de l'Ouest, will be closed thereafter.

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Namibian Sanctions Lifted By USA and Canada

US President Bush lifted anti-apartheid sanctions against Namibia on March 21, the same day Namibia became an independent nation. Canada also lifted its ban on new contracts for conversion of Namibian material. Namibia has become the 160th member of the United Nations and, by invitation, has also accepted the 50th membership in the Commonwealth of Nations.

U.S. Energy & Kennecott Restructure Joint Venture

On March 22, U.S. Energy, its subsidiary Crested Corp., and Kennecott Corp. agreed to a restructured joint venture agreement for the development of uranium properties in Wyoming. Kennecott will now be equal owners with U.S. Energy and Crested, providing $15 million to develop the properties, and $50 million to fund uranium mine development. The first development will be at Green Mountain, which has reserves of more than 50 million pounds.

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Australians Reelect Hawke

Australians reelected Prime Minister Bob Hawke for a fourth term by the narrow margin of only two seats in the 148-seat House of Representatives. Shortly before his reelection, the Prime Minister stated that he thought the Australian Labor Party's (ALP) three-mines policy would stay in effect, a view supported by ALP Resources Committee Chairman John Black.

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RECENT DEVELOPMENTS

China To Buy 2,000 MWe Soviet Nuclear Plant

China has begun negotiations with the Soviet Union to purchase a 2,000-MWe nuclear power plant. The plant would be located on the coast near Jinzhou, which is in the province of Liaoning in Northeast China.

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Olympic Dam's First Sale of Concentrates to USA

Olympic Dam Joint Ventures has received approval from the Australian government for its first sales of natural uranium concentrates to US utilities. Long-term supply contracts were signed with Texas Utilities and System Fuels.

Uranerz Buys One-Third of Cogema's Rabbit Lake Operations

Uranerz Exploration and Mining Ltd., a subsidiary of Uranerzbergbau Gmbh, reached an agreement with Cameco on April 2 to purchase a one-third interest in Cameco's Rabbit Lake uranium mining operations for C$160 million. These operations include the Rabbit Lake mill, the three Collins Bay deposits, the Eagle Point South deposit, and surrounding properties. Uranerz presently holds a one-third interest in the Key Lake uranium mine and the Eagle Point North deposit; the latter will be developed with the Eagle Point South deposit as one mine. Uranerz Chairman and CEO Gerhard Glattes stated, "The future of the uranium industry belongs to Saskatchewan. We are anxious to put our company in an advantageous position to capitalize on anticipated future increases in uranium demand. We are confident that the nuclear option for generating electricity has long-term growth potential around the world."

East and West Germany Forming Joint Nuclear Law

East and West Germany began discussions to establish a common German nuclear law by 1991. Solid results are expected within a couple of months, as the rapid pace of the re-unification efforts of the two countries are pressuring the panel of experts involved in the discussions to move quickly.

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Nova Scotia Extends Uranium Exploration Ban

Nova Scotia extended its moratorium on uranium exploration for five more years. The moratorium was originally imposed by the provincial government in 1981.

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THE LONG AND THE SHORT OF IT

or

How the buildup of excess uranium inventories inevitably led to the collapse of spot market prices and the subsequent softening of long-term prices and the role of various market participants in forcing a difficult and lengthy restructuring of the world uranium production industry.

The following is a slightly edited version of the paper presented by George White, Jr., Vice President of NUEXCO Trading Corporation, to the USCEA Fuel Cycle '90 Conference in Nashville, Tennessee on March 26, 1990.

Introduction

If asked to characterize the current uranium market, a few of the words that come to mind, depending on one's role in the market and point of view, include "DISASTROUS", "EXCITING", "WORRISOME", and "OPPORTUNE". Looking at that market, I see it dominated by the following, interrelated factors:

- Record large quantities of uranium are being bought and sold in the spot market, with perhaps equally large, additional quantities being delivered at spot prices under long-term contracts.
- Structural changes are occurring in both the long-term uranium market and the uranium production sector.
- Brokers, traders and other intermediaries are becoming increasingly active in the marketplace.
- The NUEXCO Exchange Value and other spot market price indicators are at all-time lows.

The current state of affairs in the uranium market is the logical and inevitable economic result of past excesses, primarily the buildup, during the late 1970s and early 1980s, of huge inventories.

It is my contention, however, that the current state of affairs in the uranium market is the logical and inevitable economic result of past excesses, primarily the buildup, during the late 1970s and early 1980s, of huge inventories. Today there is still substantial excess inventory in the system, and, until this inventory is absorbed, either prospectively or in fact, uranium prices will remain under pressure.

The Spot Market

It will come as no surprise that the spot market has again become a center of attention, and that criticism typically directed at traders and brokers has been expanded to include the spot market itself. Of course, the targets of that criticism, myself and NUEXCO included, view such abuse as misdirected—akin to shooting the messenger. But to ensure that we are talking about the same thing, we need to take, at least, a cursory look at the spot market.

I would suggest that, with some few exceptions, spot uranium deals typically involve:

- A fixed quantity of material;
- Delivery within 12 months or so of contract execution;
- A relatively simple contract form;
- A fixed price, known, of course, as a spot price.

Using the NUEXCO Exchange Value as an indicator, the uranium spot price attained its highest level ever in mid-1978, at more than $43.00 per pound U_3O_8. But since then, with the exception of two up-ticks that proved short-lived and failed to stem the basic downward trend, the spot price has declined steadily—for nearly 12 years now—and is currently below $9.00 per pound U_3O_8.

Due to this seemingly endless price decline, there have been recent suggestions that the spot market has, somehow, ceased to be a bona fide market and its prices have become mere contrivances that lack legitimacy. From what I can determine, such suggestions share the implied rationale that, since the brokering / trading / consulting / publishing fraternity are neither consumers nor producers of uranium, their activities, including the prices associated with those activities, should not really be considered as part of the "real" uranium market.

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It will not surprise you that I take issue with such a point of view. It is, I think, readily apparent that those who report on and presume to measure the uranium market do so from different perspectives. But as different as they are, NUEXCO, Nukem, Uranium Exchange, the World Nuclear Fuel Market (with both utility and producer members), and even McGraw-Hill's Nuclear Fuel newsletter all agree, both that there is an active spot market for uranium and that the current price level in that market is somewhere in the neighborhood of $9.00 per pound U_3O_8. I suggest that such uniformity of opinion from such diverse, wholly independent and informed sources, with obviously divergent agendas, makes a persuasive case for the existence, legitimacy, and price level of the spot market, particularly one in which nearly 30 million pounds equivalent U_3O_8 have changed hands during the past 15 months. In my view, the spot market and its reported price levels are both valid, regardless of who may elect to deal in that market.

The Inventory Situation

And what can we say about the seemingly infinite amounts of uranium that have been fueling all this spot market activity and forcing lower prices? Excess inventory remains the name of the game, and its market impact can hardly be over-stated. Inventory peaked in 1985 at more than 550 million pounds equivalent U_3O_8, half of it excess. By the end of 1989, total inventory had declined to 440 million pounds, with the excess component estimated at about 160 million pounds. At this rate it will be some time in the mid-1990s before the last of this excess is absorbed. Until then, the realities of dealing with the excess will continue to cause considerable difficulties for uranium producers as well as primary suppliers of conversion and enrichment services.

And what about the sources of all this material? Some comes from utilities and government entities who have elected to sell inventory they have come to regard as excess. Some comes from producers who, needing cash in the near-term, have been forced to sell either current production or material that had been stockpiled in hopes of higher priced sales at some future date. Most, however, is being made available through a variety of financially driven transactions, including loans, sales, and swaps, some of which are extremely complex, involving both natural and enriched uranium of different origins at multiple locations.

In this connection there are special considerations applicable to sales of borrowed uranium. The sale of such material incurs an obligation to return equivalent material at a future date. Unless the borrower covers this obligation by arranging to acquire replacement material, he is short the market and at risk. If, on the other hand, the borrower does effect cover by arranging to obtain replacement material, it might be argued that it is the party providing the replacement material that is really making the loan. Thus, the original borrower, *depending on the terms of the deals*, may be able to lock in a profit without taking any market risk.

The rate of inventory utilization is the key and is a function of the comparative rates of consumption and production. It seems clear that little can be done to increase consumption, and uranium consumption (what is burned) during the rest of this century is predictable within narrow bounds. With the average tails assay already close to 0.30 w/o U^{235} and higher assays unlikely, additional consumption via this route is not anticipated. In fact, just the opposite is more likely to happen—namely that uranium consumption will be reduced as declining SWU prices lead to lower tails assays.

Of course, it is possible to increase spot uranium demand (what is sought for purchase at a particular time) by lowering spot prices to the point that some consumers will evaluate a "buy-and-hold" strategy as economically superior to long-term procurement. But, it must be recognized that a "buy-and-hold" does not consume any uranium; it merely moves that particular lot of uranium from one inventory holder to another—from weak to strong hands. Also note that the new owner incurs carrying costs in connection with his "buy-and-hold" strategy. And it is possible that this new owner might, as a result of altered circumstances, later decide, in order to reduce those carrying costs, to become a lender, putting that particular lot of uranium in play yet again, and once again adding to supply at a particular time.

If neither consumption nor demand can alter the equation significantly, we are left with inventory itself and production. Starting with inventory, it will be apparent that as the Minimum Acceptable Inventory Level (MAIL) increases, excess inventory decreases by a like amount; this, in turn, hastens the day when excess inventory will be insufficient to make up any production shortfall. In fact, however, the opposite has happened; utility perceptions of the proper MAIL have declined in lock step with uranium prices. Such a development should not surprise us, for

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falling prices suggest plentiful supply, which, in turn, tends to obviate any perceived need for large inventories.

Of course, the most effective means of reducing excess inventory is to cut production. The impact is immediate and direct—as production declines, more inventory must be utilized to meet consumption requirements. But, as we have come to recognize over the past 10 years, reducing production is a painful process. US uranium production peaked in 1980, with more than 20,000 people in 31 different organizations producing more than 43 million pounds equivalent U_3O_8 at 44 different facilities. Contrast this to 1989, the last year of the decade, when 2,000 people in 12 organizations produced just over 13 million pounds at 16 facilities. Many of us have long-time friends who are not here because they are no longer in the business. It is rather like a death in the family.

And who is to blame? For those seeking to vent their anger, the broker / traders represent handy and highly visible targets. Their apparent ability to grow and prosper in the current, difficult environment has clearly frustrated some producers. As a very consequence of their commercial abilities, as well as their willingness to continue to invest in the nuclear fuel business, the trading and brokerage firms have, for some, become objects of suspicion and vilification. But castigating the deal makers does not alter economic reality. Every transaction requires willing participants, and it has been my observation, during some 19 years with NUEXCO, that deals do not get done unless they make sense. The broker/traders have been and continue to serve as expert expediters of activities *desired by the market*.

But what happens when the market sees the end of the excess inventory and prices turn up? A price reversal, real or anticipated, could, particularly if sudden or sharp, result in new thinking—that the proper MAIL should also be higher, reflecting the increasing supply risk inherent in an environment of rising prices. In this scenario, prices surge sharply higher as buyers try to increase their inventory levels even as producers, in order to match high uranium consumption rates, struggle to increase output by as much as 50 percent. However, the prospect of a buying panic akin to that of the mid-1970s is, in my view, most unlikely, for a number of reasons:

- As noted above, estimates of future consumption now have very narrow error bands; in the 1970s, forecasts of future consumption reflected almost exponential growth, based on highly uncertain estimates of capacity additions.
- Uranium resources are now recognized as adequate to support almost any credible level of nuclear growth; such was not the case in the 1970s when there was genuine concern, in some quarters, that there might not be enough uranium to go around.
- With the advantages of considerable experience and hindsight as well as a more predictable future, market participants are less likely to be stampeded than they were in the 1970s.

No one should be particularly surprised that falling spot prices are forcing long-term prices lower, or that lower prices are, in fact, performing their classic economic functions of forcing production cutbacks, and supplanting high-cost operations with more efficient, lower-cost production.

The Longer-Term Market

At the same time, however, it must be recognized that spot market developments in general and spot market prices in particular have and continue to significantly affect the longer-term market. Thus, declining spot market prices have resulted in:

- Reduced revenue from existing long-term contracts where delivery prices are keyed to the spot market. In some cases this has led to sub-economic production operations and subsequent decisions to close down.
- Lower base prices in new, non-spot market related, long-term contracts which must compete with both internal and external "buy-and-hold" strategies.
- The inability of some current and would-be producers to conclude new long-term contracts at prices, terms and conditions that will allow profitable operations.

No one should be particularly surprised that falling spot prices are forcing long-term prices lower, or that lower prices are, in fact, performing their classic economic functions of (1) forcing production cutbacks, and

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(2) supplanting high-cost operations with more efficient, lower-cost production. The highest cost producers, except for those enjoying the protection of high-priced contracts, were the first to close, to be followed by those with successively lower costs.

Talking about uranium prices in public forums is, at best, a risky business, and I have no wish to say anything that might, yet again, enable legions of anti-trust lawyers to enrich themselves at our collective expense. Nevertheless, I think it is safe to assert that few uranium producers can operate profitably at selling prices of $9.00 per pound U_3O_8. Thus, and to a degree that has not existed in the past, there is now broad industry consensus that *current* spot market prices are essentially independent of the economics of uranium production. And to the extent that long-term prices are tracking down with spot prices, long-term prices have also disengaged (albeit more gradually) from economically justifiable levels. However, the willingness to admit that current price levels are inadequate to support a viable uranium supply industry in the long term, has not, for the most part, been translated into any sort of willingness to write new long-term contracts at price levels adequate to motivate or support new production ventures.

A new problem for the traditional Western producers has been the emergence of China and the Soviet Union as suppliers of natural and enriched uranium; both appear intent on and capable of carving out significant market shares for themselves. And recent political developments around the world would certainly appear to give fresh impetus to more peaceful, less confrontational, and more interdependent economic and trading systems. Indeed, why not Bulgarian uranium? Or French conversion? Or Japanese SWU?

Conclusion

Given the liquidity of the current market, it is clear that long-term uranium prices cannot rise until spot prices begin their recovery. For the same reason, I think that interest rate considerations and arbitrage-type transactions will control the future divergence between spot and longer-term prices. Now, however, spot prices are a function of transactions involving the ongoing, and, at times, circular movement of excess inventories through the market, and, until that inventory is absorbed, no real price recovery is possible. And, unfortunately for the long-suffering producers, it appears that the only realistic way to accelerate that process is through further production cuts.

In closing I would note that the inventory build-up was an accident waiting to happen. Neither the general situation nor this particular message has changed much during the past several years. What has changed, or should have changed, is our recognition of the situation —specifically, that the rationalization of the uranium market is proving to be a longer rather than a shorter process. ■

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LIABILITY IN SHIPPING RADIOACTIVE MATERIALS

The following is a slightly edited version of a presentation by Robert L. Bovey, President of NuTranS, to the USCEA Fuel Cycle '90 Conference in Nashville, Tennessee, on March 26, 1990.

This presentation primarily covers the shipment of fresh fuel materials—natural uranium concentrates and uranium hexafluoride—although lessons learned in shipping those materials may have some application to shipments of spent fuel, radioactive waste, or isotopes.

To the credit of the industry, transportation accidents have been rare and accidents involving any direct exposure of uranium cargo have been extremely rare. In over forty years, only a handful of uranium concentrate spills have occurred, and absolutely no uranium hexafluoride spills have taken place during transportation. And as a general rule, without an accident, the question of liability will not be tested.

Nonetheless, it is prudent to ask two questions about the hypothetical serious transportation accident: What would have to be paid for, and who would pay it? Among the costs that might have to be borne are those of:

- Damages to others, personal injury, or property damage;
- Cleanup and environmental restoration;
- Emergency forces actions;
- Legal fees and fines.

Potentially Liable Parties

Among the parties who might be called upon to bear some or all of these costs are the carrier, the shipper, the owner, and perhaps even the receiver of the material being transported, and, of course, their insurance companies. One may examine a set of accident scenarios and find it difficult to conceive of an accident in which the carrier would not be primarily responsible, if fault is found at all. Nevertheless, I will argue that in the current US legal environment, any party remotely connected with a shipment in which a serious transportation accident occurs can expect to be named a defendant in one or more law suits, particularly if that party represents the so-called "deep pocket." I am told that European society is not nearly so litigious; nevertheless, prudence demands that those involved in shipments overseas also assume the need to defend themselves in the event of a serious accident.

Of the organizations represented at the USCEA Fuel Cycle '90 Conference, I doubt that many are without some exposure. And within those organizations, I expect the people at this conference will be among the first to be called into action in the extremely unlikely event of a serious transportation accident. Because the best defense is to avoid the undesirable situation in the first place, you might want to ask several questions:

- If your organization is involved in making transportation contracts or influencing them:
  - Is award of transportation contracts made on the basis of price, solely or even primarily?
  - How are potential transporters "qualified"?
- If your organization is involved even remotely in the shipment of nuclear fuel materials:
  - What instructional material is available to the workers who are actually handling your shipment on what to do under normal and under accident conditions?

Evaluating Insurance Coverage

Clearly, insurance is an important tool in reducing the level of liability exposure of your organization. There are a number of questions regarding insurance that should be addressed:

- Are we utilizing all the insurance that is readily available to us?
- Do we know what insurance is carried by our transporters, shippers, and receivers and whether it provides protection to us?
- Do any of these policies require advance notification?
- How do we allocate insurance costs?

In most cases, regardless of where your organization stands with respect to a shipment, there are ways to share insurance at little or no cost among the parties who have an interest in a particular shipment. This sharing can include, for example, other parties being named as "additional insured" on one party's insurance policy. It may be worthwhile to activate these ways, if for no other reason than to reduce the potential for bickering and confusion in the unlikely event of a serious accident.

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Some insurance policies call for the timely reporting of each shipment to the insurance company with such information as departure and arrival dates, transportation modes, cargo descriptions, etc. If an insurance policy contains such a notification requirement, after an accident is not the time to implement notification procedures. However, it is easy to fall into bad habits when nothing has ever gone wrong in a shipment in which your organization has had an interest.

The relevance of the fourth question above is less obvious than the other three. It reflects the fact that the combined effect of management performance evaluation systems and cost allocation procedures in large organizations can lead to unintended and undesirable consequences. If managers are evaluated on their cost containment performance and corporate insurance costs are allocated by some formula reflecting how much a business unit uses insurance, the result may be to discourage managers from insuring shipments.

Amount of Coverage

A major question concerning liability insurance is, How much is enough? As in the case of other questions raised here, I cannot give an answer that will apply to all organizations. However, you may want to ask, Is the coverage high enough to give the insurance company the incentive to defend your interests against all claims? In other words, Will the insurance company see the prospective legal costs as so great that its own interests would be better served by simply settling up to the limits of its policy? And, if it does so, where do you stand with respect to residual claims?

For example, if you look at a US trucker's business transportation liability policy, you may well find a combined (bodily injury and property damage) limit of liability of one million dollars, the minimum required under US law (49 CFR 387.9) for a trucker who carries feed material. Whatever number you find, you will want to ask whether it is sufficient for your circumstances.

Geographical Coverage

You also need to know if you are covered in all the places you might be exposed. For example:

- Is Canada covered?
- Are there gaps at national boundaries?
- Are there gaps at intermodal transfer points?

Because of the special and close relationship that exists between the USA and Canada, some US insurance companies treat Canada together with the US as "domestic"; but others treat Canada as "foreign." Obviously, you want to determine that whatever you are shipping in Canada—even if it is only a transit through a Canadian port—is covered somehow. If, for example, one insurance company is providing coverage inside the USA and another outside, you may ask each company what constitutes US territorial waters and airspace. Similarly, if your organization is depending, perhaps only in part, on your carriers' insurance, find out the details of the shipment plan and whose insurance covers the shipment when it is being transferred from one carrier to another.

Familiarity with Policy

Finally, I do have clear, albeit partial, answers to two important questions. The first is, how do you find out the answers to the questions above? I submit that a necessary—but unfortunately not sufficient—condition for getting answers is to read the relevant insurance policies in their entirety. On several occasions I have been told by the representative of a company that it had this or that insurance coverage, only to find upon further investigation that the desired coverage was totally absent. I am absolutely confident that these representatives were not deliberately misrepresenting the facts; they simply did not know any better.

Secondly, I would urge you to ensure that the policies have been read lately. A number of changes have been and are taking place in the structure of the insurance on which the transportation of nuclear fuel materials depends. The general trend of these changes has been to further restrict the public liability coverage afforded to industry, including coverage concerning pollution in general and coverage of radioactive cargoes. Therefore, the conventional public liability insurance you have today may not afford the same coverage that you had a year ago.

Conclusion

While the circumstances of every organization are different, all have a need to review at least periodically their posture with respect to liability during transportation of radioactive materials. If it has not been done within the last few months in your organization, I recommend you consider doing so with the appropriate professional assistance. I hope that the questions raised in this presentation will be helpful in starting the process. ■

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SOUTH KOREA'S NUCLEAR FUEL INDUSTRY

March 1990 marked a major milestone for South Korea's nuclear power program, as the country became self-sufficient in nuclear fuel fabrication. The reconversion line (UF_6 to UO_2) came into full operation at the Korea Nuclear Fuel Company's fabrication plant (**Figure 1**), as the last step in South Korea's program, initiated in the mid-1970s, to localize fuel fabrication. Thus, South Korea now has the capability to produce both CANDU and pressurized water reactor (PWR) fuel assemblies.

This article covers the nuclear fuel industry in South Korea—how it is structured, its current capabilities, and its outlook for the future.

Structure of the Industry

Nuclear fuel activities are conducted for the Korea Electric Power Corporation (KEPCO) primarily by two organizations, shown in **Figure 2**. The Korea Atomic Energy Research Institute (KAERI) carries out all nuclear fuel research and development, CANDU fuel fabrication activities, and the fuel and reactor core design activities for both CANDUs and PWRs. The Korea Nuclear Fuel Company, Ltd. (KNFC) is responsible for all PWR fuel fabrication activities.

KNFC is currently owned five percent by KAERI and 95 percent by KEPCO, which is the ultimate beneficiary of KNFC's activities—that is, the user of its services. KEPCO is a state-run corporation, under the jurisdiction of the Ministry of Energy and Resources, and KEPCO is the owner and operator of all South Korea's nuclear power plants.

KAERI is an institution under the jurisdiction of the Ministry of Science and Technology. Prior to January 1990, KAERI was called the Korea Advanced Energy Research Institute, but the reorganization on January 4 spun off its nuclear licensing activities into the Korea Institute of Nuclear Safety (KINS). The new KAERI is responsible (among other things) for reactor research and development, and for reactor design activities.

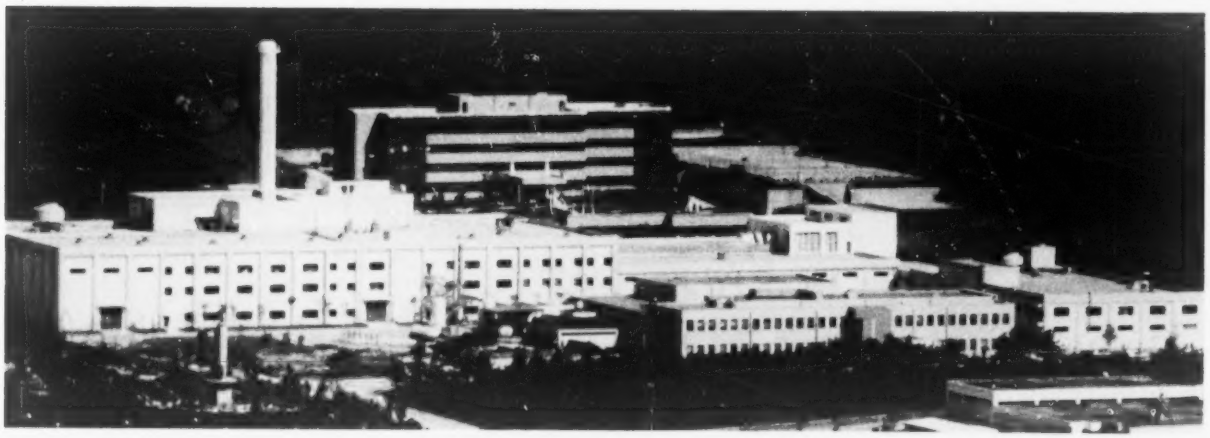

Figure 1. KNFC's fuel fabrication facility at Taejon.

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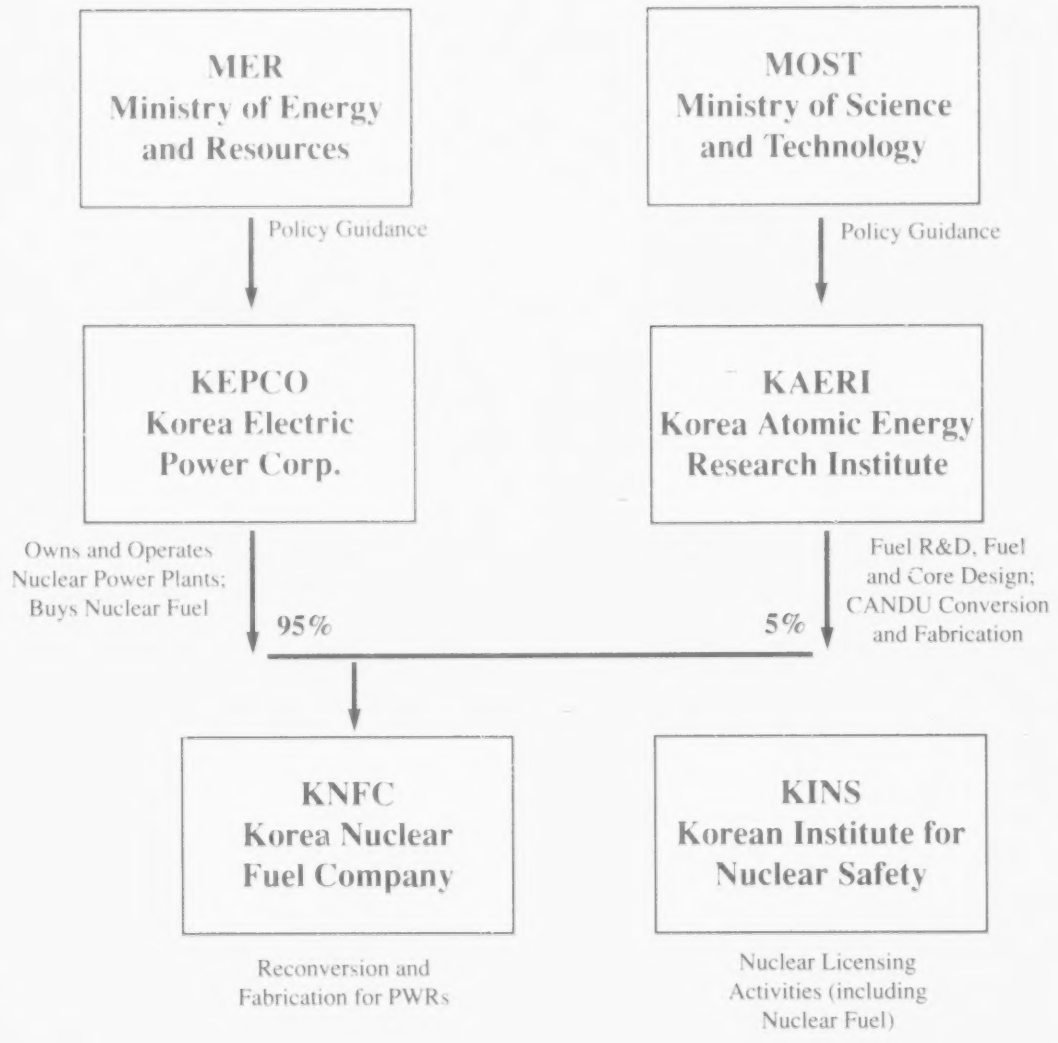
Figure 2
SOUTH KOREA'S
NUCLEAR FUEL ORGANIZATIONS



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All these fuel design and production activities are carried in a very integrated fashion among KEPCO, KAERI, and KNFC. In fact, the KNFC fuel fabrication plant and corporate offices are located at the same site as KAERI's facilities, at Daeduk Science Town in Taejon.

Development of CANDU Fuel Capability

KEPCO has one CANDU-type reactor in operation (Wolsong 1) and is in the process of procuring a second unit at the Wolsong site. Even before the first commercial operation of Wolsong 1 in April 1983, KAERI had developed a pilot plant for CANDU fuel research. In 1981, the decision was made to proceed with CANDU fuel localization.

In the three-year period 1984-86, KAERI produced a total of 408 prototype CANDU fuel bundles, which were loaded into the Wolsong unit. These bundles performed well, which led to the expansion of the pilot facility to its full commercial size of 100 MTU per year, starting in January 1987. This size is more than sufficient to supply the 85 MTU-per-year needs of Wolsong 1, and this capacity can be easily expanded to meet the additional needs of Wolsong 2, scheduled to come on-line in 1997.

Through the end of 1989, KAERI has supplied over 11,000 fuel bundles for Wolsong 1. None of the discharged fuel bundles have been found to be defective, attesting to the high quality of the program.

In addition to the CANDU fuel bundle fabrication program, KAERI carried out a concentrate to UO2 conversion development program. A laboratory-scale facility of one MTU per year was built in 1983, followed by a ten-MTU-per-year pilot plant in 1984. By 1985, KAERI had brought on-line an automated powder production facility of 25 MTU annual capacity, producing material for 24 lead test bundles for Wolsong 1. The current 100 MTU-per-year plant came into commercial operation in 1988, giving South Korea full self-sufficiency in CANDU fuel production.

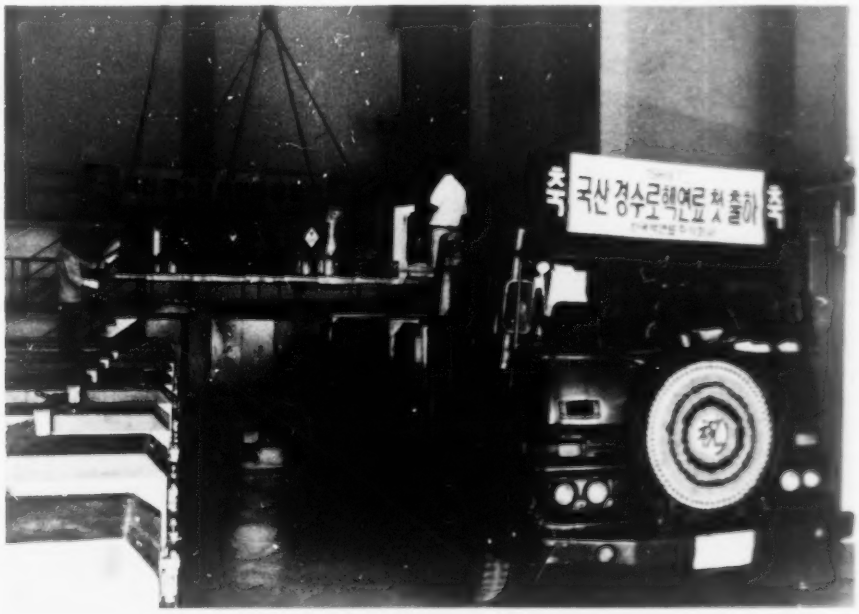

Figure 3. Loading of first KNFC PWR fuel assemblies for shipment to Kori-2.

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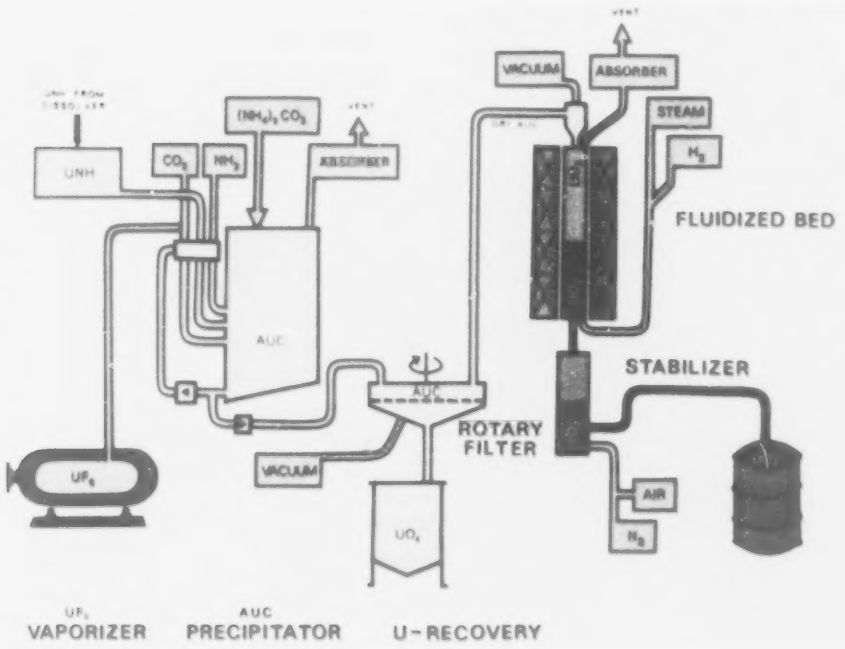

Figure 4. South Korea's AUC Reconversion Process.

Development of PWR Fuel Capability

The PWR fuel localization plan was developed by the South Korean government in 1981, leading to the formation of KNFC in November 1982. An agreement was reached with the Siemens subsidiary Kraftwerk Union (KWU) in 1985 for nuclear fuel technology transfer.

The first step of this effort was the training of KAERI engineers, who were sent to West Germany in early 1986. This led to the joint development of Korea Fuel Assemblies (KOFA). Three fuel types were developed under this effort:

- 14x14 for the Kori Unit 1;
- 16x16 for the Kori Unit 2;
- 17x17 for the six other PWRs.

Construction on the 200-MTU-per-year fuel assembly fabrication plant at Taejon was started in November 1986, and first commercial operation of this facility was achieved in October 1988. During this period, preliminary fuel designs for these fuel types were being developed jointly with KWU. These designs were completed in August 1988. **Figure 3** shows the first assemblies produced at the plant, being loaded on trucks for shipment to Kori Unit 2. The first loadings of KNFC fabricated fuel into Kori Unit 2 were in February 1990.

In conjunction with this PWR assembly plant, the uranium reconversion (UF_6 to UO_2) process used was developed by KAERI and is called the AUC Reconversion Process–AUC for Ammonium Uranyl Carbonate. This process is outlined in **Figure 4**. The design of this facility was started in June 1986, and construction was started in December 1987. During the period prior to startup of this reconversion facility, the reconversion requirements of the fuel assembly plant were supplied by the Siemens subsidiary RBU (Reaktor Brennelement Union GmbH) in West Germany. The KNFC reconversion facility, as mentioned above, came into operation in March 1990.

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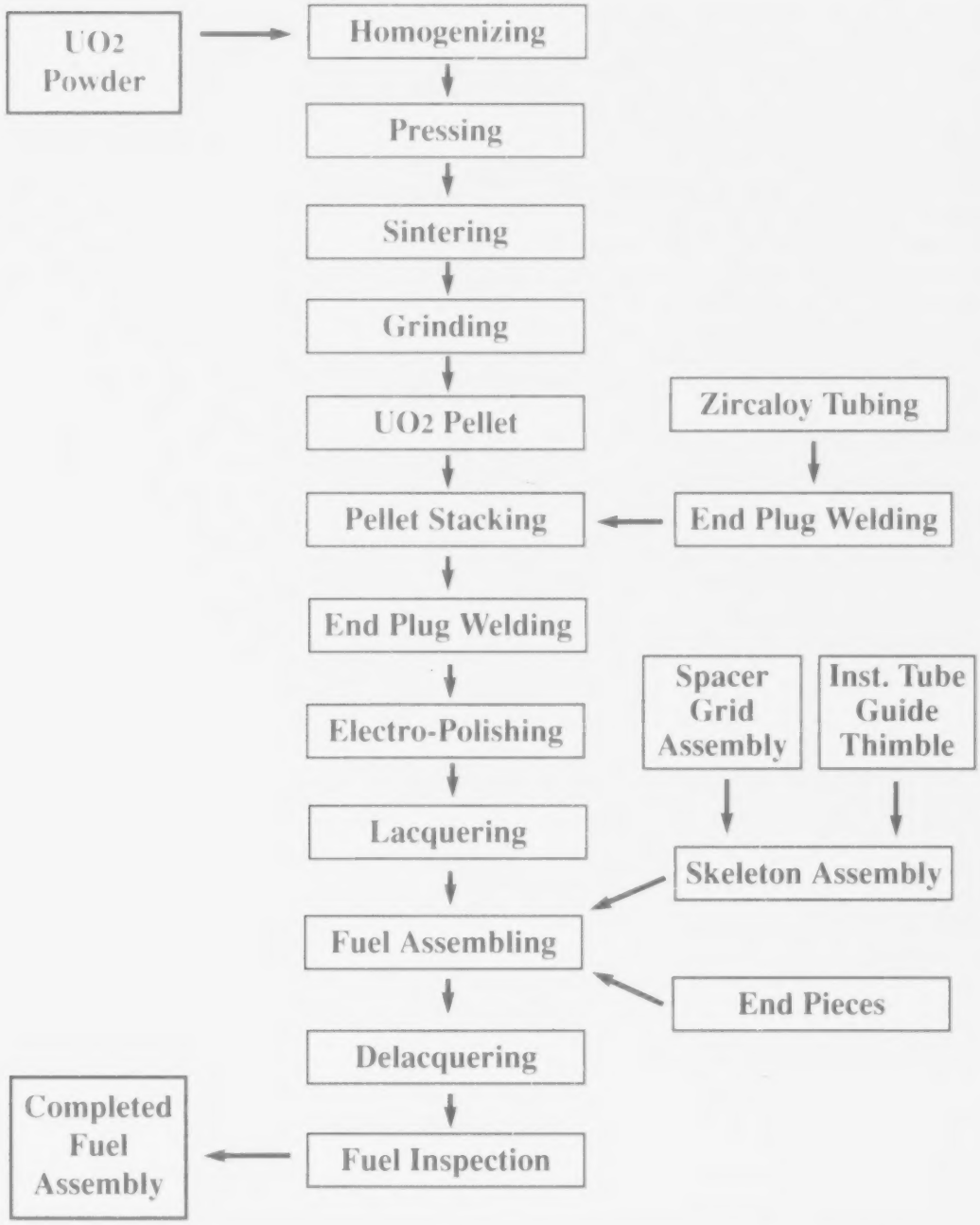
Figure 5
FABRICATION PROCESS FLOWCHART



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The process steps in the fuel assembly fabrication plant are shown in **Figure 5**. These steps cover the initial stage of pellet fabrication from UO_2 to final assembly and inspection. At this stage, KNFC is fully self-reliant for all the process inputs except for Zircaloy cladding tubing and for Zircaloy straps (used for assembling the spacer grids).

The fuel fabrication plant itself covers about 19.5 thousand square meters, and the 200-MTU-per-year capacity (both reconversion and assembly fabrication) is equivalent to about 450 fuel assemblies. The current load on the plant, for the eight operating PWRs of KEPCO, is about 340 fuel assemblies annually. The plant currently employs about 390 people.

PWR Fuel Assembly Design

An important element of the South Korean nuclear fuel program is technological self-sufficiency, not just manufacturing self sufficiency. To this end, South Korea is carrying out joint nuclear fuel research and development programs with its reactor vendors (Westinghouse, Framatome, Combustion Engineering, and the AECL in Canada), as well as with Siemens in West Germany. The success of this element is clear from the development of indigenous fuel designs for the KEPCO nuclear power plants.

The current design is referred to generically as the Korea Fuel Assembly, but this covers designs for the three configurations mentioned above. The heart of this KOFA concept is the 17x17 assembly, shown in **Figure 6**. This assembly has several significant differences from similar Westinghouse and Framatome offerings. The KOFA design has a thicker cladding, which should provide better mechanical integrity. In addition, the KOFA design has thicker, stronger hold-down straps.

Kori Unit 1 (using the 14x14 design) and Kori Unit 2 (using the 16x16 design) are both operating on 15-month cycles, whereas the other PWRs are on annual cycles. KEPCO is considering moving from annual cycles to 18-month cycles, and feasibility studies for the longer cycles are being carried out now by KAERI. These studies should be completed by the second half of this year, with possible implementation of the longer cycles in the early 1990s.

In addition to KEPCO's possible shift to 18-month cycles, KAERI is actively pursuing further design evolutions—referred to as Korea Advanced Fuel Assembly (KAFA) Versions 1 and 2. KAFA-1 is being developed for the 17x17 configuration, since most of KEPCO's PWRs use this configuration. The KAFA-1 concepts could be applied to the other two (14x14 and 16x16) configurations later. The advanced features of KAFA-1 are compared to the KOFA design in **Table 1**. As the table shows, the improvements are in discharge burnup, the use of axial blankets, mixing vanes in spacer grids, and debris resistance features.

Table 1
ADVANCED FEATURES OF KOFA-1 COMPARED TO KAFA (17x17 Type)

Content	KOFA[1]	KAFA[2]	Remarks
Discharge Burn-up (MWD/MTU)	38,000	43,000	• 14% Increase in Discharge Burn-up • 7% Reduction in Total Fuel Cycle Cost
Use of Axial Blanket	No	Yes	• Improvement of Neutron Economy • 3% Reduction in Total Fuel Cycle Cost
Use of Mixing Vane in Spacer Grids	No	Yes	• Improvement of Thermal Performance • Improvement of Safety and Operational Margin
Use of Debris Resistant Feature	No	Yes	• Enhancement of Fuel Mechanical Integrity

[1] KOFA: Korea Fuel Assembly
[2] KAFA: Korea Advanced Fuel Assembly

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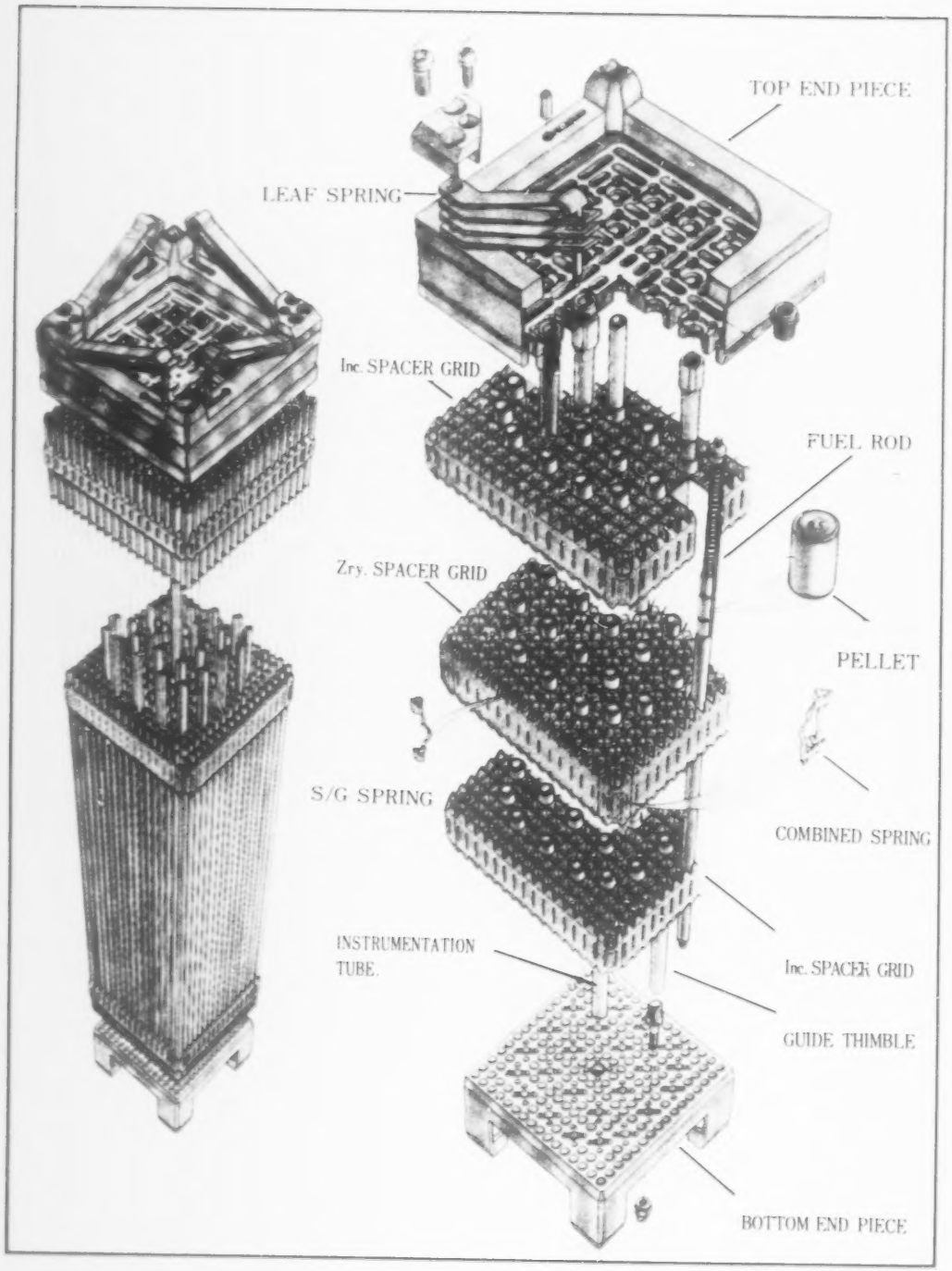

Figure 6. 17x17 Type Korea Fuel Assembly.

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All analyses relating to KAFA-1 should be completed by the end of 1993, followed by submission of a Fuel Design Report to the KINS in 1994. Licensing of the KAFA-1 would then be expected by the end of 1995, with implementation starting in 1996.

The KAFA-2 design will depend on the results of KAERI research and development of cladding materials and fuel pellets for even higher burnup. Thus, exact specifications are not yet available. However, the major development activities for KAFA-2 are expected to commence in 1995, with the first assemblies being supplied to KEPCO as early as the year 2001.

KEPCO, as the ultimate user of KAERI's fuel design services, has expressed dissatisfaction that the schedule for developing these advanced fuel schemes lags the "state of the art," as established by non-Korean fabricators. Whether an advancement of these schedules will occur is uncertain, but the pressure to do so is clear.

In addition to the advancement of PWR fuel designs, KAERI is also pursuing research and development of advanced CANDU fuel bundles. This new bundle design is expected by 1997.

Conclusions

South Korea's rapid industrialization and near-miraculous economic growth in the past two decades would not have been possible without the important contribution of nuclear power to meeting South Korea's electricity requirements. Because of its strong commitment to nuclear power, KEPCO has been able to keep up with double-digit growth in electricity demand at reasonable costs. Consequently, nuclear power now accounts for half of South Korea's electricity production—among the highest percentages in the world.

It seems clear to South Korea's policy makers that nuclear power must continue to play a key role in its economic development. Security of supply is a major consideration in South Korea's commitment to nuclear power; thus, it is quite appropriate that South Korea has vigorously pursued a goal of self-sufficiency in nuclear fuel fabrication—both in design and in fabrication. The culmination of this goal in March 1990 is a tribute to South Korea's foresight and determination. ■

Dr. R. Gene Clark

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Nuclear Industry Calendar

1990

Apr. 8–12	***First Annual International High-Level Radioactive Waste Management Conference*** (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meeetings Department at 1-312-352-6611.
Apr. 9-11	***23rd JAIF Annual Conference*** (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056.
Apr. 22-25	***INFO '90*** (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
Apr. 23-27	***1st Regional Seminar for the Middle East and Europe on Management of Quality for Nuclear Power Projects*** (Prague, Czechoslovakia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400, Vienna, Austria.
May 15-17	***Annual Meeting on Nuclear Technology 90*** (Nuremburg, FR Germany). Contact Deutsches Atomforum e.V., Conference Office JK 90 at 0228 507223.
May 21-23	**1990 Nuclear Power Assembly** (Washington, DC). Contact American Nuclear Energy Council at 1-202-484-2670.
June 3-7	***30th Annual Conference of the Canadian Nuclear Association and 11th Annual Conference of the Candian Nuclear Society*** (Toronto, Canada). Contact Canadian Nuclear Association, 111 Elizabeth Street, Toronto, Ontario, Canada M5G 1P7.
June 4-8	***International Symposium on Nuclear Techniques in Exploration and Exploitation of Energy and Mineral Resources*** (Moscow, USSR). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
June 10-15	**American Nuclear Society Annual Meeting** (Nashville, Tennessee). Contact American Nuclear Society at 1-708-352-6611.
Sept. 4-7	***International Seminar on the Costs and Financing of Nuclear Power in Developing Countries*** (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
Sept. 5-7	***Uranium Institute 15th Annual Symposium*** (London, United Kingdom). Contact the UI at 44-1-225-0308.
Sept. 16-19	***Uranium Seminar '90*** (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.

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CALENDAR

Nuclear Industry Calendar (continued)

1990

Sept. 23-28	***ENC '90 Congress & Exhibition*** (Lyon, France) organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact Dr. P. Feuz, European Nuclear Society at 31-21 61 11.
Oct. 14-16	***World Nuclear Fuel Market Annual Meeting*** (Toulouse, France). Contact Donna Cason at 1-404-447-1144.
Nov. 11-14	***Nuclear Energy Forum*** (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

1991

May	***Second International Conference on Transportation for the Nuclear Industry*** (Bournemouth, England). Contact The Conference Secretary, The Institution of Nuclear Engineers at 01-698 1500. After May 6, 1990, the number will be 081-698 1500.

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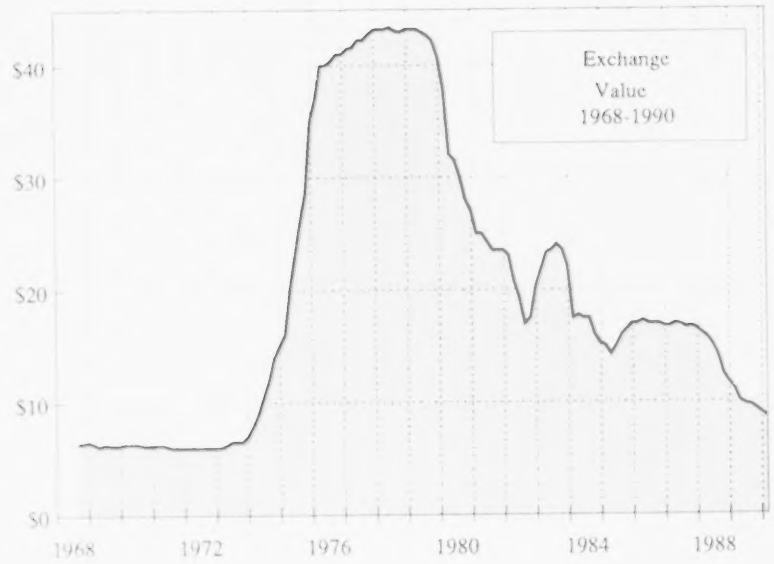
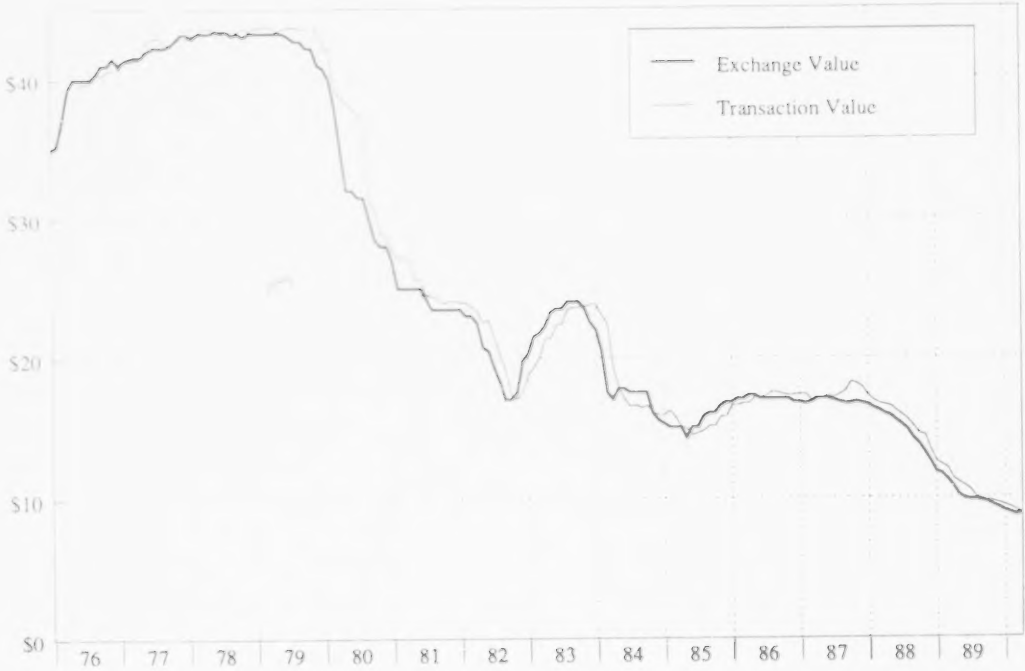
NUEXCO Historical Exchange and Transaction Values

(In US Dollars/Pound U_3O_8)





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HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES

Determined as of the last day of the month indicated ($US/lb U_3O_8)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	**8.80**									

US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated ($US/lb U_3O_8)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	**Discontinued**	

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UF6 VALUES

Determined as of the last day of the month indicated ($US/kg U as UF_6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	**24.40**									

US UF6 PREMIUM (Relative to the UF6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	**Discontinued**	

TRANSACTION VALUES

Determined as of the last day of the month indicated ($US/lb U_3O_8)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.50	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	**8.75**									

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HISTORICAL MARKET DATA

LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	**3.50**									

* Float with Prime Rate

CONVERSION VALUES

Determined as of the last day of the month indicated ($US/lb U as UF6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	**1.45**									

SWU VALUES

Determined as of the last day of the month indicated ($US per SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	**50**									

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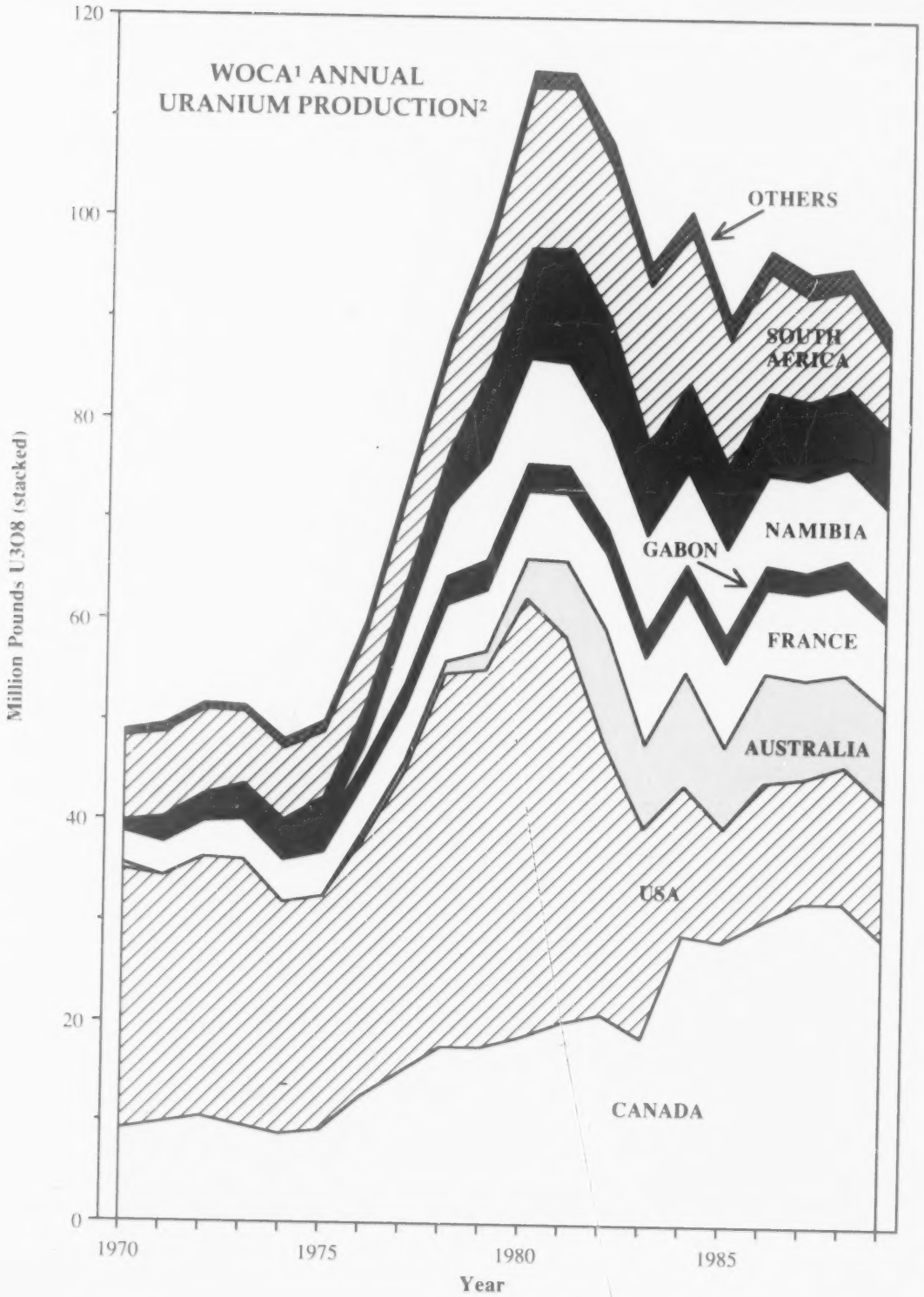

1 WOCA = World Outside of Centrally-Planned Economic Areas.

2 Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Other—2.3).

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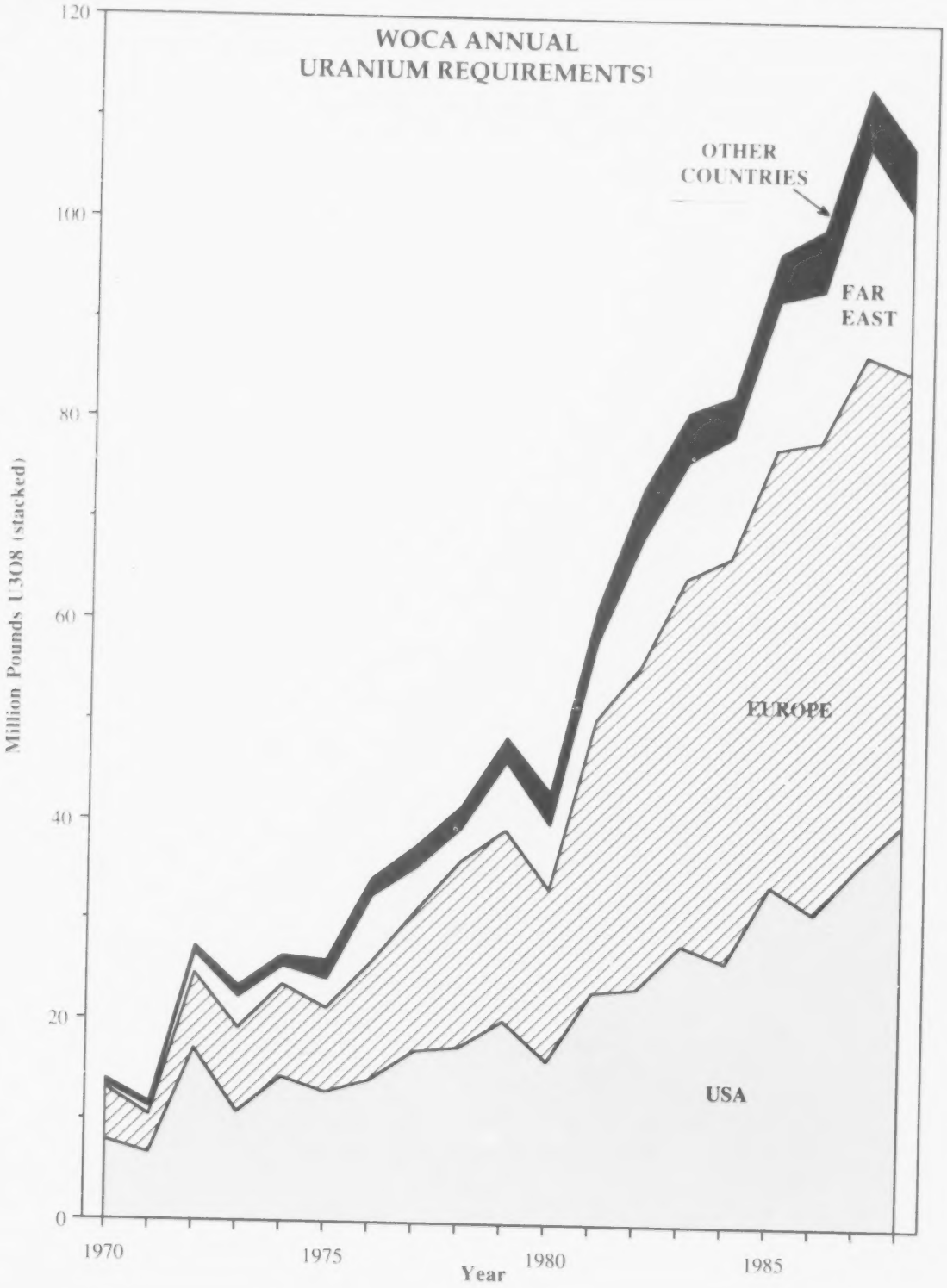
HISTORICAL MARKET DATA



[1] Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

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AUSTRALIA

		Consumer Price Index[1] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[2] (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia (Australian dollars)[3]	Award Rates of Pay Indexes: Australia - Adult Males In Mining Wage Earners, Weekly Rates[3] (June 1985=100)
1980	Avg.	95.8	83.1	—	140.9
1981	Avg.	105.0	85.9	—	154.1
1982	Avg.	116.7	89.0	—	174.9
1983	Avg.	128.5	96.9	—	181.9
1984	Avg.	133.6	98.0	—	194.4
1985	Avg.	142.6	107.3	—	103.7
1986	Avg	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.0	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	530.40	123.7
June	1989	192.6	119.9	—	124.7
July	1989	—	120.1	—	126.2
Aug	1989	—	119.2	539.30	126.2
Sept	1989	197.0	117.7	—	126.3
Oct	1989	—	117.8	—	126.5
Nov	1989	—	118.0	547.20	126.9
Dec	1989	—	118.2	—	126.9
Jan	1990	—	119.2	—	126.8

P = Preliminary **R** = Revised since last month

[1]Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.
[2]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).
[3]Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.
[4]Monthly data for the period 1967 to 1986 appear in Report 233.
[5]Base: June 1976 = 100.
[6]Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

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GOVERNMENT STATISTICS

CANADA

		Industrial Products Price Index: All Commodities[1] (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Wage-earner Data: Average Hourly Earnings (C$)[2] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.6	153.7	22.60	20.64	18.78	13.93	14.75
Dec	1989	130.2	153.6	22.80	20.50R	18.93R	13.62R	14.77R
Jan	1990	130.4	154.9	21.88P	20.37P	19.01P	13.99P	14.85P
Feb	1990	131.3	155.8	—	—	—	—	—

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

[3]Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

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REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100)[2]	Consumer Price Index[3] (1985 = 100)	Production Price Index All Groups[4] (1985 = 100)	Total Employment in Mining and Quarrying[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand)[5]
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
Jan	1989	—	—	166.8	165.5	714,593	704,320
Feb	1989	—	—	168.2	168.5	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1	702,746	695,843
Apr	1989	—	—	173.1	173.8	658,677	634,344
May	1989	—	—	175.9	176.4	706,056	721,263
June	1989	113.76	267.0	177.7	177.1	706,810	720,586
July	1989	—	—	179.3	178.8	711,648	775,002
Aug	1989	—	—	181.8	180.7	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7	708,222	780,723
Oct	1989	—	—	185.1	183.9	689,017	—
Nov	1989	—	—	187.0	185.6	—	—
Dec	1989	120.79	282.0	189.4	187.2	—	—
Jan	1990	—	—	192.0	188.8	—	—
Feb	1990	—	—	193.3	—	—	—

P = Preliminary **R** = Revised since last month

[1]Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.
[2]Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.
[3]Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.
[4]Central Statistical Service, Pretoria: All commodities for consumption in South Africa.
[5]Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

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HISTORICAL MARKET DATA

UNITED STATES

		Producer Price Index[1]		Consumer Price	GNP Implicit Price	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	Index[2] (1982-1984 = 100)	Deflator[3] (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.8R	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.51R	14.16R	13.31	10.52
Jan	1990	114.2	114.9	127.4	—	13.71P	13.96P	13.32R	10.51R
Feb	1990	113.6	114.4	128.0	—	—	—	13.24P	10.56P

P = Preliminary R = Revised since last month

[1]US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2]US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3]US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4]US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY[1]
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC[2] (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts[3,4]		Spot Contracts[3,4]	
			Average Price in ECU per pound U3O8	Average Price in US Dollars per pound U3O8	Average Price in ECU per pound U3O8	Average Price in US Dollars per pound U3O8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75
1987	14,000	17.0	ECU 28.25	$32.50	ECU 15.00	$17.25
1988	12,500	4.5	ECU 26.92	$31.82	ECU 13.65R	$16.13R

R = Revised

[1]The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.
[2]The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.
[3]For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.
[4]Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) [1]

Year	Total Production (million pounds U_3O_8)	Deliveries to Domestic Utilities From US Suppliers[2] (million pounds U_3O_8)	Average Price of Delivered Uranium[2] ($/lb. U_3O_8)	Quantity of Uranium Imported[3] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	27.6	$16.10	3.6	n/a	1.2
1977	29.9	27.8	$19.75	5.6	n/a	4.0
1978	37.0	31.6	$21.60	5.2	n/a	6.8
1979	37.5	33.0	$23.85	3.0	n/a	6.2
1980	43.7	35.0	$28.15	3.6	$43.10	5.8
1981	38.5	32.6	$34.65	6.6	$32.90	4.4
1982	26.9	23.5	$38.37	17.1	$25.19	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6
1987	13.0	20.8	$27.37	14.8	$19.14	1.0
1988	13.1	17.6	$25.65	15.8	$19.03	3.3

[1] Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*
[2] Data for 1976-1981 includes both domestic utilities and agents
[3] Includes imports by domestic utilities and domestic suppliers

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